Owings Mills Transit Oriented Development Planning Study

Maryland Department of Planning

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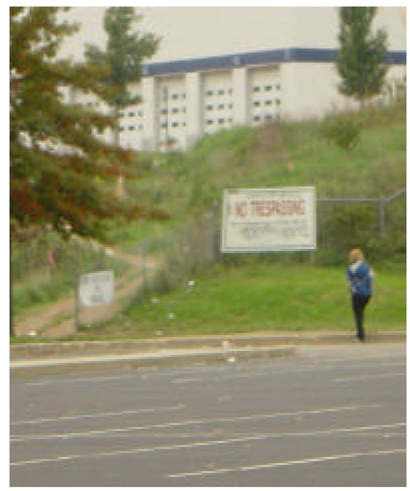
I Introduction and Background

Picture 1-1

The purpose of this document is to summarize the findings of the EPA Owings Mills grant. This report reviews existing conditions in the Owings Mills plan area and analyzes alternative growth scenarios for potential land use, transportation, and auto emission effects. It makes recommendations and findings for development policies and analysis. In addition, a 3-D visualization analysis was conducted as an experimental add-on.



Picture 1-2

While the Maryland Department of Planning (MDP) is the primary author of this report, the Baltimore County Office of Planning, the Maryland Department of Transportation, and the Baltimore Metropolitan Council were very helpful and provided important insights, data, comments, etc. In addition, the Center for Clean Air Policy provided helpful analysis on potential air quality impacts from the various future development scenarios.

It is MDP's intent to use this report with the partners mentioned above to continue to work on the development issues in Owings Mills. This report focuses on the application of several analysis tools to the Owings Mills area in a way that has not been done before and to serve as a catalyst for addressing development issues in Owings Mills. Using MDP's detailed land use analysis with the transportation models was unique. This may lead to further analyses in other areas in Maryland.

Picture 1-3

Owings Mills, Maryland is a fairly dense, new town type development mostly built over the past 20 years. The Owings Mills Metro Stop is the northwest terminus of the Baltimore Metro. While Owings Mills has both development and transit, it does not have Transit Oriented Development (see Pictures 1-1 – 1-3). However, the area still has land with development potential, including green-fields, infill, and possible redevelopment potential. In addition, Owings Mills has a fairly compact development pattern (see Pictures 1-4 – 1-6). These factors provide potential to make the area more transit oriented. In addition, several key underdeveloped as well as undeveloped parcels are close to the subway stop.

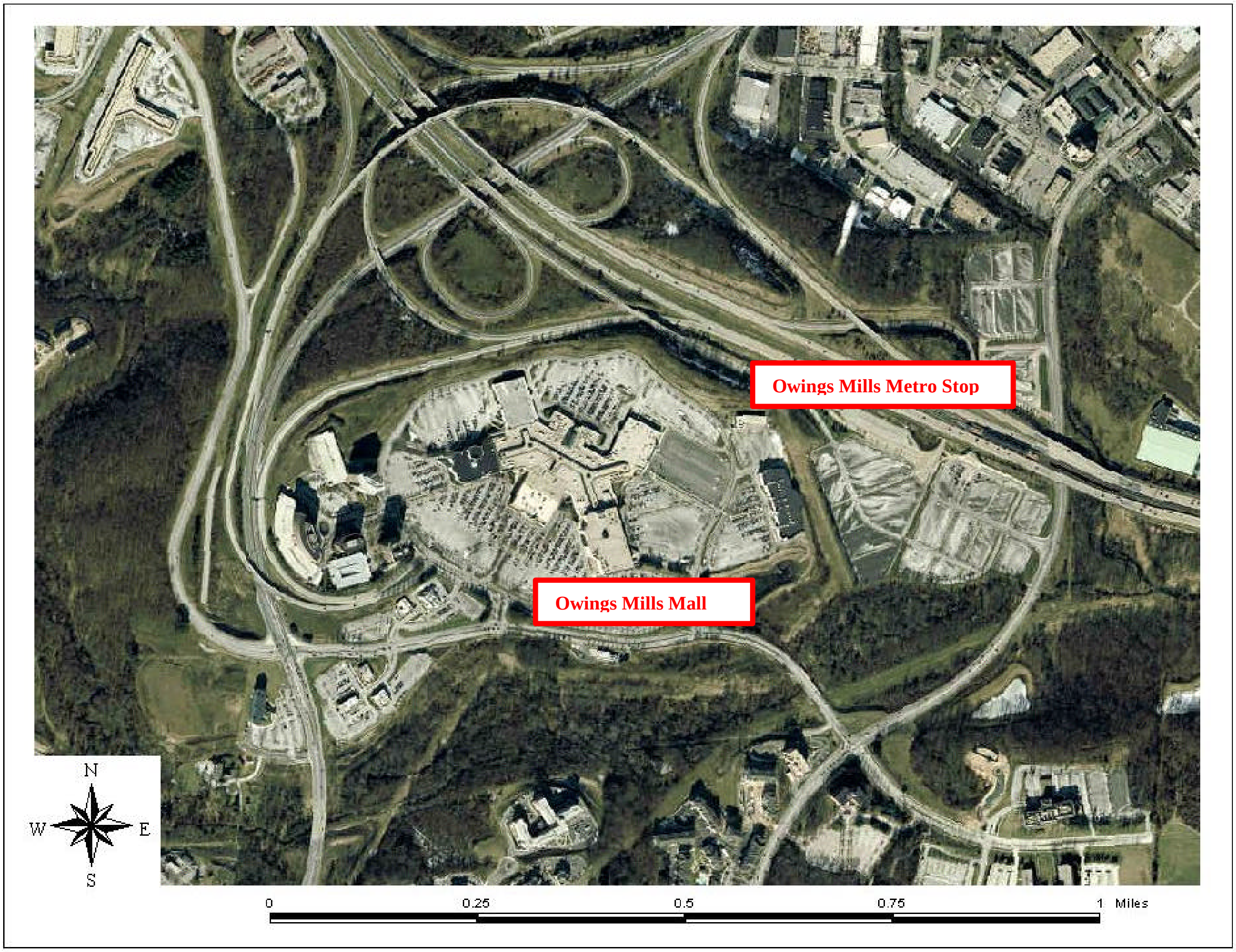


Figure 1-1 Aerial Image of Owings Mills Mall/Metro Stop

The northern part of the Baltimore subway system (a single line system) terminates at Owings Mills, Maryland--an unincorporated community in Baltimore County approximately 5 miles outside of the Baltimore Beltway. It was designated a growth area in the County's 1979 master plan: "Baltimore County Master plan 1979 – 1990." Pursuant to this plan, the County adopted the "Owings Mills Master Plan" in 1984. The Owings Mills plan outlines existing conditions, projections, planning objectives and policies, implementation recommendations, etc. These issues are updated and revisited in the Baltimore County "Master Plan 2010."

Picture 1-4 – Neighborhood Retail and Office

Picture 1-5 – Compact Office Use

Under its implementation section, the Owings Mills plan articulates a vision for the area around the Metro stop. Page 54 of the plan calls for "A transit station linked through related, space-sharing uses to the Mall and a focal point of a group of significant institutions and activities is going to be far different from the typical station, isolated from its surroundings by acres of parked cars." Ironically, what the vision said the Metro station area should not be is a good description of its current condition (see Pictures 1-1 through 1-3).

Picture 1-6 – Residential Development

Several attempts have been made to develop the area around the Metro station that could reflect the vision. Within the last few years, the Maryland Transit Authority (MTA) and Baltimore County have worked together to develop a detailed mixed use, market driven, development plan for the site. They also worked together on a RFP to find a master developer for the project. A development firm was selected and the development plan seemed to be making progress. However, the recession of the late 1990s and early 2000s caused the developer to withdraw from the project. While the MTA and the County continue to try to move forward, more recent issues related to land ownership have caused further hurdles.

Regardless of these problems, this area will likely be developed at some point in the future. Developable land is limited in Baltimore County and in the region. In addition, the Owings Mills area continues to experience significant development pressure. These factors, and the County and MTA's commitment to develop this site in a transit oriented manner, will likely lead to the site being developed in the future.

It is also important to try to connect existing and planned development in the study area (i.e., the Owings Mills Master Plan area, see Figure 1-3) to the Metro station. In addition to the transit befits, such an approach will also help to make Owings Mills more of an interconnected community. Much of its current land uses and transportation network are disjointed. However, this may be improved with an approach that leads to the strategic planning for future development and redevelopment in the area.

The benefits of Transit Oriented Development have been discussed in many areas for many years. Owings Mills is an interesting case study of transit-oriented development (TOD). It is a new town that was planned around a subway stop. To some degree, the relatively dense development with a variety of land uses has occurred as planned. However, the TOD around the Metro stop has not occurred.

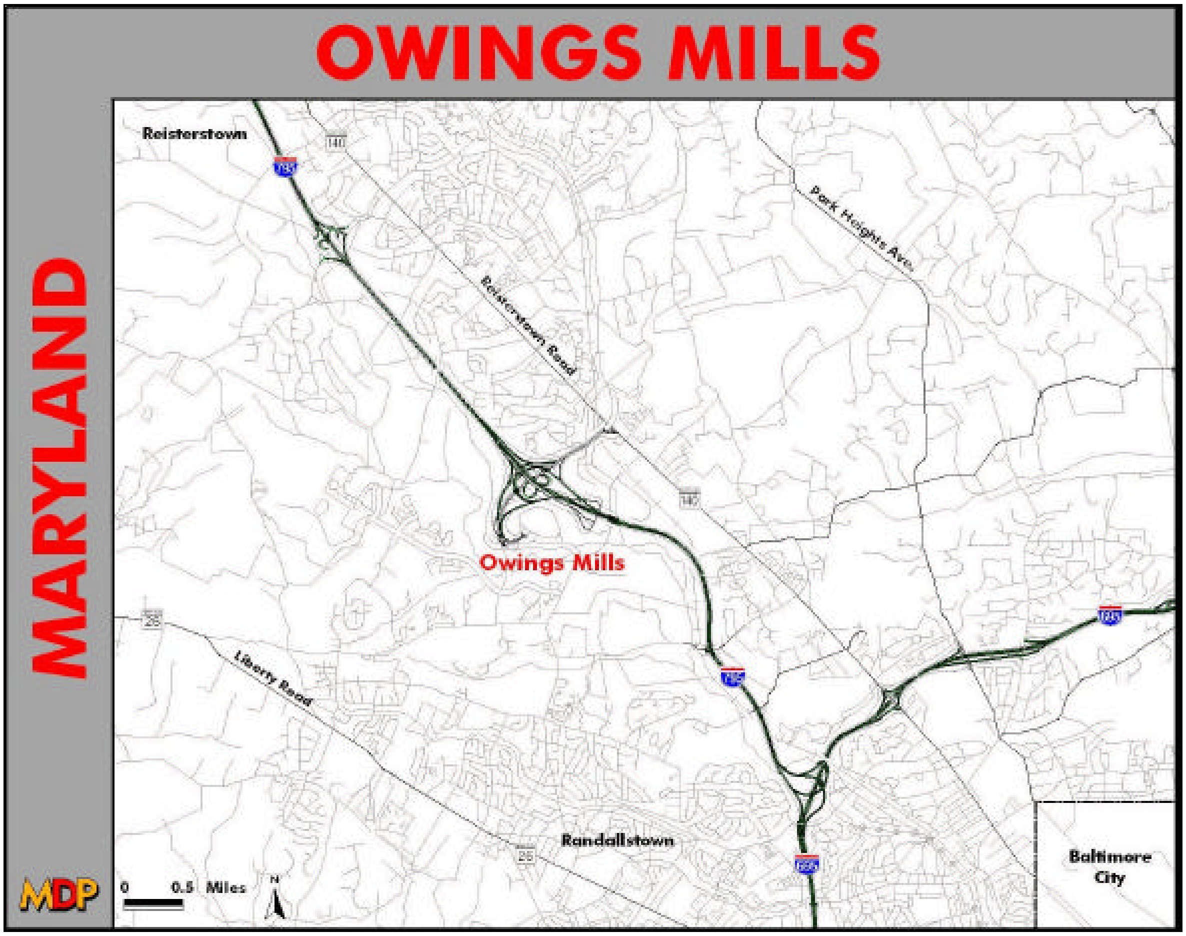


Figure 1-2 Locational Map

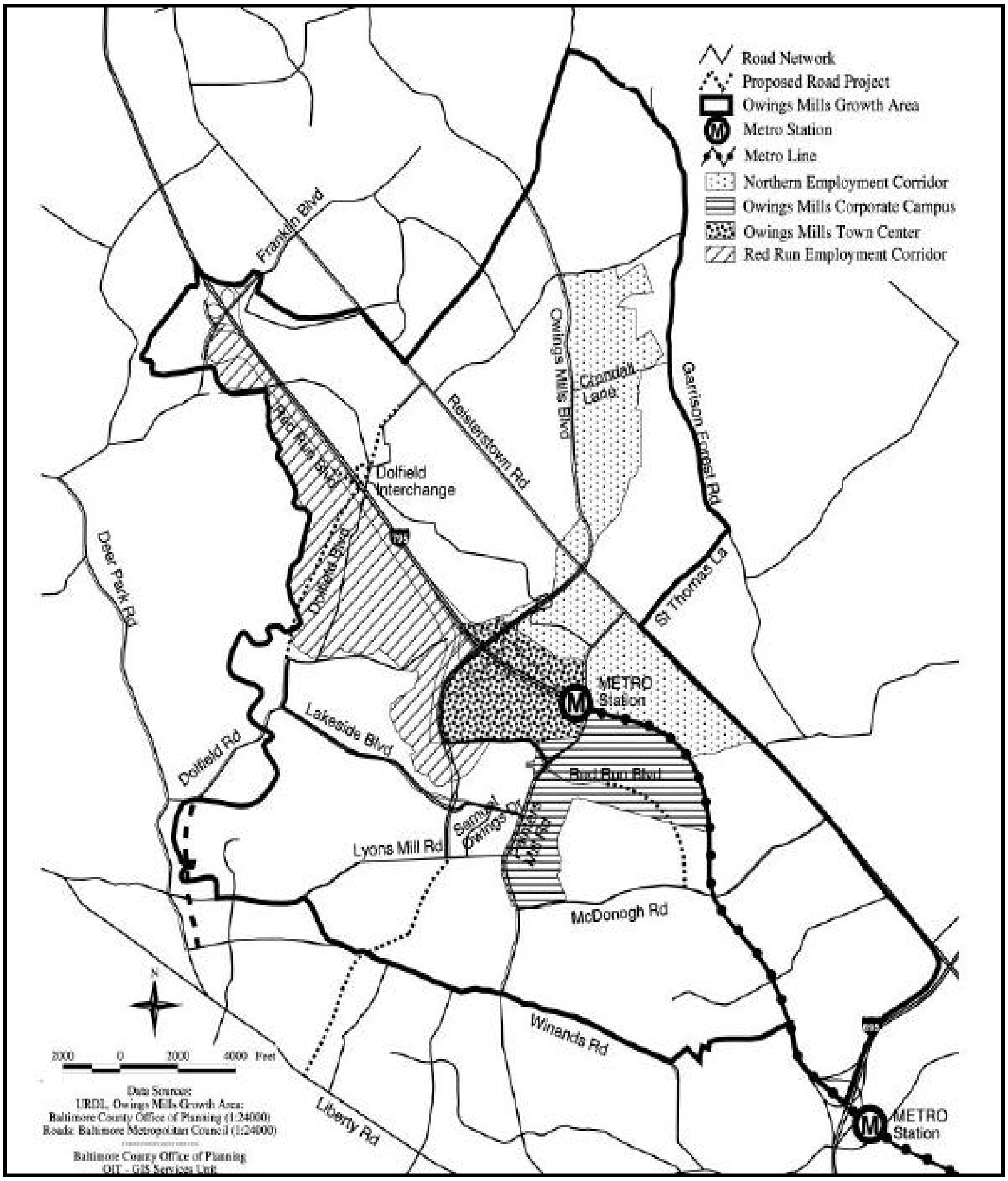


Figure 1-3 Owings Mills Study Area
(Source: Baltimore County "Master Plan 2010")

II Findings and Recommendations

This report is a hybrid between land use and transportation modeling and planning policy analysis. It also may serve as a catalyst and resource for updating or refining the Owings Mills Master Plan. Outlined below are findings and recommendations based on the analysis and related work for this project.

Future Development

Future growth in the Owings Mills area should occur according to a detailed strategic approach that maximizes access to the Metro station and interconnects mixed land uses with existing and future compact growth. While these basic objectives are part of the master plan for the area, there is a need to not only consider them at the area's master plan scale, but also at the detailed site / project level. To some degree, the key remaining developable lands should be subject to the type of planning that occurred for the Owings Mills Town Center development plan. Results from both the transportation and land use analyses support this recommendation (see below).

Results from the land use scenarios show that implementing denser, transit oriented mixed-use development standards would enable the Owings Mills plan area to accommodate significantly more projected households and employment than current zoning allows. This is important in a jurisdiction such as Baltimore County, which has limited capacity for future growth. In addition, growth that cannot "fit" into the County's growth areas (which Owings Mills is a major one) may occur in more of sprawl setting outside of growth areas and / or outside of the County. Replicating the development standards simulated in the scenarios in Owings Mills will not be easy, even though they are based on real examples. The analysis serves as an illustration of what could occur under several sets of assumptions about growth (i.e., scenarios).

Reisterstown Road

While mostly on the eastern edge of the Owings Mills study area, the Reisterstown Road corridor should be factored into any strategy for the area. The road has a variety of land uses along its corridor—much of which resembles commercial strip development (see Pictures in Chapter III). The State and County may want to consider steps to divert through traffic to adjacent I-795 and take traffic calming and streetscape steps to help make Reisterstown Road more of a community road. In addition, the County should consider establishing links between the Reisterstown Road corridor and the Metro station and Town Center.

Transportation Modeling and Analysis Tools

Metropolitan Planning Organizations' (MPOs) models should be more capable of analyzing the effects of land use alternatives such as those modeled in this project. In addition, models such as Smart Growth Index should be able to link to the MPO's model. This is important since the MPO's model plays an important role in the region's transportation planning. The two types of transportation models also operate at different scales, making it hard to use them together. Like most regional transportation models, Baltimore Metropolitan Council's (the MPO) 4-Step Transportation model is designed to operate mostly at a county and regional scale. Therefore, it is not oriented to be sensitive to alternative land use scenario characteristics at the TOD scale. Since TOD and related land use approaches are considered important in transportation planning, models used for transportation planning should be able to adequately measure their impacts.

Land Use Modeling

Land use modeling needs to be done with significant local planning input and data. MDP's Growth Simulation Model was used for the land use scenario work in this project. This model is designed to work at the parcel level. MDP worked closely with County planning staff to fine-tune data and assumptions about zoning districts, buildable land, projections, etc. MDP also assembled detailed development information from prototype developments (e.g., Ballston and King Farm) to be used as realistic input for the alternative future scenarios. Therefore, the land use scenarios are based on real-world information and assumptions.

Output from MDP's land use analysis can assist Baltimore County's Planning Department in determining the development capacity of parcels for each scenario. It can also help target areas for development and redevelopment. This information could be helpful for plan development.

Analysis Findings

1. Land Use Scenarios

The following summarizes the land use analysis results (See Chapter IV for more details).

a. Current Trends Scenario

This scenario simulates the projected growth (Round 5C TAZ projections) to the year 2025 assuming current zoning and policies stay the same. Under this scenario, only 25% of the projected households and 50% of the projected employment could “fit” into the Owings Mills study area. In order to accommodate Round 5C projected growth (the projections have recently changed for the Owings Mills area), denser growth and more infill development needs to occur. If current trends continue, key remaining developable parcels may be developed without any attempt to provide increased connectivity in the area. In addition, density and mix of land uses could be less than optimal.

b. TOD Scenario

This scenario simulates significant development and redevelopment on land adjacent to the Metro station. Ballston (in Arlington County, VA) was used as a prototype for the density and mix of land uses. Several key parcels within one mile of the Metro stop were also assumed to have higher density and more of a mix of land uses than is currently planned. These parcels were simulated as being built in a form analogous to the King Farm project in Rockville, MD.

This increase in density and mix of land uses allowed the study area to accommodate almost 70% (compared to 25% for the Current Trends Scenario) of the projected households and 150% of the projected employment.

c. TOD & Mixed Use Scenario

This scenario builds on the TOD Scenario by using the King Farm mixed-use development as a prototype to parcels previously identified with significant development capacity throughout the entire study area, not just near the Metro station.

Simulating these changes to projected growth in the Owings Mills area enables it to accommodate 101% of the projected household projection and 195% of the employment projection for the study area.

2. Transportation Scenarios

The following summarizes key findings from the transportation analysis. Please see Chapter V for more details on this work. The transportation scenarios build on the land use scenarios. Output from the land use scenarios (see Chapter IV) was fed into the transportation models.

Three models or analysis tools were used for the transportation analysis:

- Baltimore Metropolitan Council's (BMC) Four Step Travel Demand Model for macro-scale analysis;
- EPA's Smart Growth Index for micro scale analysis; and
- Center for Clean Air Policy's Greenhouse Gas (GHG) emission analysis methodology that uses output from the BMC model.

In general, the TOD Scenario resulted in lower VMTs and more non-motorized trips. At the site level, the air quality results were mixed (contrasting results from the different models). At the site level, the SGI model showed a reduction in CO2 emissions and the CCAP (based on the BMC outputs) showed a significant increase in these emissions. It was difficult to compare the results on the different analyses used for this part of the project. This was not a surprise. By design the BMC model is to be used for Metropolitan Planning Organizations (MPOs), such as the Baltimore Metropolitan Council. It is not designed for use at the scale MDP used it, nor is it designed to be sensitive to the projected land use alternatives outlined in Chapter IV. Since the Center for Clean Air Policy's GHG emission analysis is based on output from the BMC model, limitations from that model got transferred to the GHG analysis.

The Smart Growth Index (SGI) model is best suited for this project. However, its geographic scale is limited for key parameters (1 - 2 mile radius from Owings Mills Mall) and it does not link to the BMC model. The study area for this project (the Owings Mills Master Plan area) is approximately 13,000 acres. By contrast, the approximate 1-mile radius limit on SGI equals 2,000 acres (15% of the study area). Therefore, the SGI was helpful for analyzing scenarios in and adjacent to the Metro stations; however, it could not account for the scenarios' effects on the balance of the study area without using the model's sampling method.

The following are highlights of the analysis. These highlights compare the 2025 Current Trends Scenario with the 2025 TOD Scenario. It is important to keep in mind that the TOD Scenario projects significantly more growth to the TOD site.

- The BMC model estimates a 1.1% reduction in vehicle miles traveled (VMT) for the whole County based on the TOD scenario analysis, which was run on the three transportation analysis zones (TAZs) proximate to the Metro station (approximately 10% of the study area). This reduction would result in a .6% reduction in VMT for the Baltimore Region. At the project site level, however, the VMTs went up according to the model. This is a result of increased development projected to the site.
- While these percentages seem small, they are significant when one considers that the effects of the TOD scenario (a subset of the study area) are being measured at the County scale. In addition, more growth is projected to the TOD area in the TOD Scenario.
- The BMC model also estimates a 3.6% increase in transit trips at the county scale and 1.2% for the regional scale as a result of the TOD Scenario compared to Current Trends Scenario. The same limitations of scale mentioned above apply here. Therefore, these percentages are more dramatic at the project scale.
- Non-motorized trips, as measured by the BMC model, increased by 18% at the County scale. Again, the scale issue also applies here. Therefore, the percent increase at the project or even study area scale is more dramatic.
- The SGI model results show a higher imbalance between employment and housing compared to the Current Trends Scenario. This is due to the fact that the TOD Scenario projects significantly more employment to the TOD area.
- The SGI also showed a VMT decrease in the TOD Scenario of 1.9 to 2.9% per capita in the TOD area. The scale and units used in the SGI make these results difficult to compare to the BMC model.

III Background Analysis and Existing Conditions

Since existing and project development was in integral component of this project, a significant amount of effort was put into assembling and integrating information about these issues. There were numerous meetings with the project partners about the issues such as zoning yields, developable parcels, potential for infill and redevelopment, future development, growth projections, etc.

Appendix A shows a summary of some of this work. This information greatly improved MDP's Growth Simulation Model by providing it with customized information. This work also helped improve the alternative future development scenarios. MDP staff also conducted several site visits to Owings Mills and to the prototype developments of Ballston and the King Farm project in Rockville, MD. This helped to further customize the analysis and to improve realistic graphics for the project.

One of the key improvements to the growth model for this project was to categorize the customized development capacity information. The model has an estimate for every parcel; however, for the purposes of this project, we also created four categories of development capacity in order to improve the development scenario analysis.

These four tiers of development capacity are:

- Tier 1 - Large Developable Greenfield Parcels;
- Tier 2 - Large Underdeveloped Parcels and Redevelopment Opportunities;
- Tier 3 – All Other Parcels with Development Capacity as Determined by the Growth Model;
- Tier 4 – Older Commercial and Industrial Parcels with Redevelopment Potential; and
- Tier 5 – Parcels with Land Value is Greater than the Improvement Value (potential for redevelopment).

Appendix A shows maps of these parcels in the study area. It also shows air and ground photos of examples of each tier of development. This helped to provide better information for the growth model and to demonstrate that its inputs were grounded in reality.

IV Alternative Futures Development Scenarios

Three key alternative future development scenarios were created for the Owings Mills Growth Area. These scenarios were developed to illustrate the potential land use, transportation, and air quality effects of contrasting future growth scenarios. Several types of analysis tools (i.e., models) were used for different aspects of the scenarios. The three key scenarios are outlined in the table below. Each projects growth (households and employment) to the year 2025.

Scenario	Purpose	Models Used
Current Trends	Shows projected growth per current development policies, regulations, and trends.	MDP's Growth Simulation Model, EPA's Smart Growth Index, BMC's 4-step Transportation Model, CCAP Analysis, and CommunityViz.
TOD Scenario	Illustrates the potential effects of TOD development in the subway stop area of Owings Mills – partially scaled to Ballston, VA.	MDP's Growth Simulation Model, EPA's Smart Growth Index, BMC's 4-step Transportation Model, CCAP Analysis, and CommunityViz.
TOD & Mixed Use	Builds on the previous scenario by building more compact, mixed use development in areas with development capacity and outside of the primary TOD area. These mixed-use developments are partially scaled to the King Farm project in Rockville, MD.	MDP's Growth Simulation Model.

Scenario Development

The design of the scenarios was driven by the purpose of the project: to investigate how future growth in the Owings Mills Plan Area could occur under several scenarios. Key issues to analyze include land use (type, density, mix, location, etc.), transportation (mode split, demand, circulation, etc.), and related air quality issues. The scenarios were developed by close collaboration with Baltimore County Office of Planning staff. Scenario development also relied on much of the background and existing conditions information summarized in Chapter III.

The scenarios were designed with careful consideration of actual conditions, projections, policies, and the characteristics of prototype development projects for the scenarios. This allows for consistency, transparency, and transferability from the policy plan level to the zoning level. It also allows for transferability between the land use and transportation analyses (sometimes at the parcel scale). In other words, the scenarios allow for analysis at several levels: ranging from the policy plan level to detailed land use and transportation analyses at the parcel scale.

Scenario Analysis

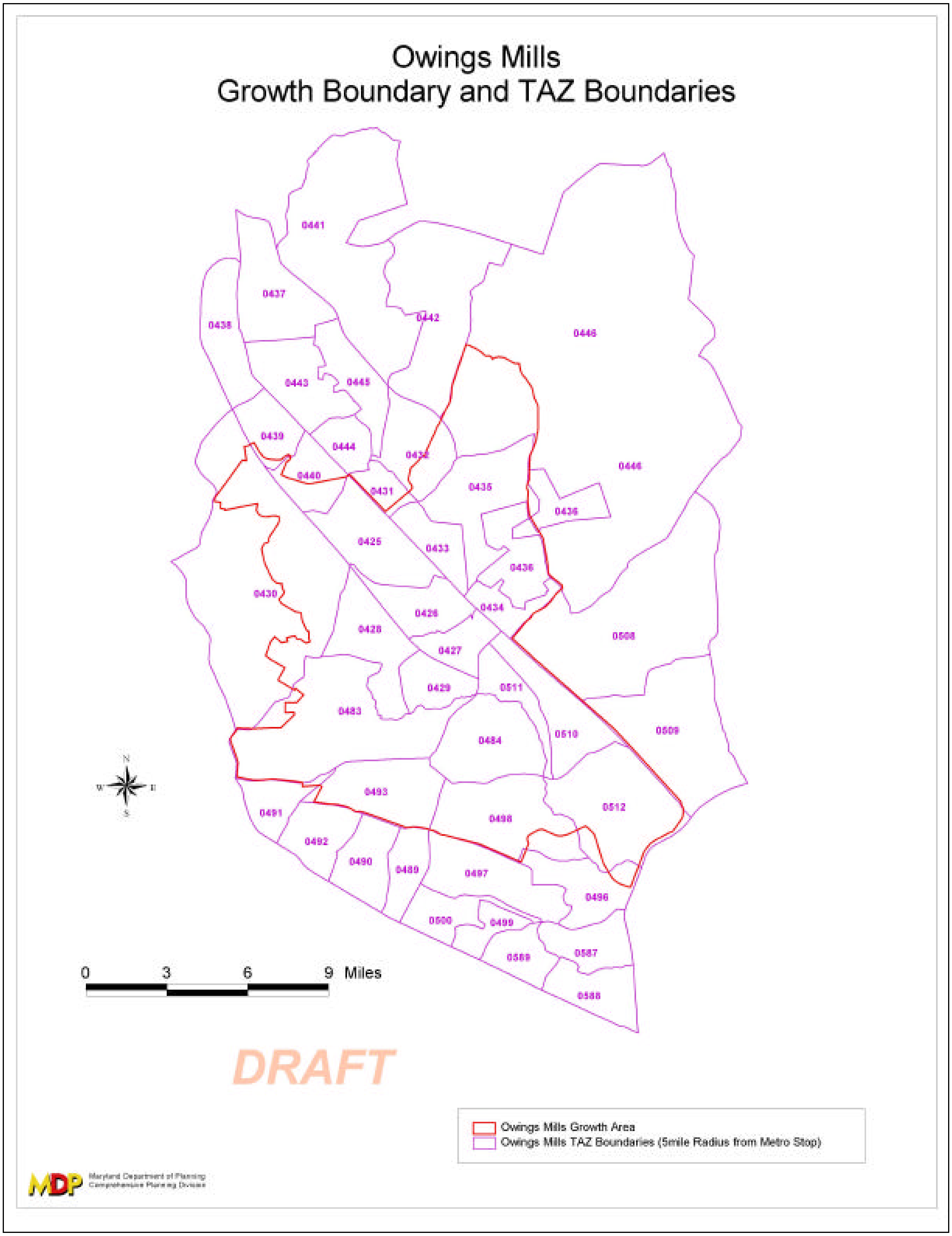
Each of these scenarios was run for the entire Owings Mills Growth Area. Each of the scenarios was created using examples of alternative development patterns that can be found "on the ground" in other places. We collected information about several Pilot Projects to come up with the specific information for the three scenarios. Appendix B shows the background information related to the prototype projects that were used in the analysis.

For this analysis, the Baltimore Metropolitan Council's Round 5C TAZ projections were used as a target for the number of jobs and households that should be allocated to the Owings Mills Growth Area. Table 4.1 shows the Round 5C projections by TAZ within the Owings Mills Growth Area. Figure 4-1 shows the Project study area with the TAZ boundaries.

Based on these projections, Owings Mills is expected to accommodate 21,530 additional people between 2000 and 2025, 12,615 additional households, and 43,950 additional jobs.

Even though newer rounds of the TAZ projections have recently been done for the area, the project team decided to continued to use Round 5C because it directed significantly more growth (households and employment) to the Owings Mills area.

Table 4.1: Round 5C TAZ Projections for the Owings Mills Area						
TAZ	**Population 2000**	**Population 2025**	**Household 2000**	**Household 2025**	**Employment 2000**	**Employment 2025**
425	1,666	1,591	639	664	1,402	1,402
426	2,970	3,335	1,261	1,476	258	583
427	0	0	0	0	4,036	5,676
428	886	4,296	411	2,001	500	4,515
429	0	690	0	300	8,280	21,560
430	2,510	5,555	882	2,077	2,716	13,586
432	2,452	2,737	854	1,004	139	169
433	3,124	3,489	1,624	1,909	265	320
434	1,280	1,430	632	742	1,527	1,852
435	296	331	119	139	3,692	4,482
436	540	695	2	2	1,378	1,648
440	1,035	1,070	417	497	1,128	1,128
483	3,884	15,559	2,441	10,391	680	1,685
484	26	106	15	65	4,192	10,392
493	1,649	1,904	670	850	78	93
498	3,033	3,018	1,157	1,182	411	421
510	2,213	1,913	1,140	1,145	8,193	12,843
511	65	55	2	2	740	1,160
512	1,347	2,732	379	814	770	820
Total	**28,976**	**50,506**	**12,645**	**25,260**	**40,385**	**84,335**


Owings Mills
Growth Boundary and TAZ Boundaries
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Owings Mills Growth Area
Owings Mills TAZ Boundaries (5mile Radius from Metro Stop)
MDP
Maryland Department of Planning
Comprehensive Planning Division

Figure 4-1

1. Current Trends Scenario

The Current Trends Scenario simulates what could happen in the Owings Mills Growth Area if current trends and policies remain constant in the future. MDP worked with the Baltimore County Office of Planning to come up with residential and non-residential density yields that represent what would likely happen if trends continue. Table 4.2 shows these allowable densities.

In this scenario, we assumed that the immediate parking lot area would not be redeveloped, rather it would be left as a surface parking lot, and that connectivity to the adjacent mall, businesses, and residential areas would remain the same.

Table 4.2: Zoning Summary

Zoning Map	Description	Allowable Density		Zoning Map	Description	FAR for Commercial/ Industrial Zones
DR1	Low Density Residential	0.89 du/acre		OR1	Commercial	0.30
				OR2	Commercial	0.30
DR2	Low Density Residential	1.12 du/acre		O3	Commercial	0.30
				OT	Commercial	0.30
DR3_5	Medium Density Residential	2.43 du/acre		BLR	Commercial	0.30
				BL	Commercial	0.30
DR5_5	Medium Density Residential	2.79 du/acre		BL_AS	Commercial	0.30
				BM	Commercial	0.30
DR10_5	High Density Residential	7.60 du/acre		BM_AS	Commercial	0.30
				BM_CR	Commercial	4.00
DR16	High Density Residential	7.92 du/acre		BR	Commercial	0.20
				BR_IM	Industrial	0.30
RAE1	High Density Residential	12.82 du/acre		MLR_IM	Industrial	0.30
RAE2	High Density Residential	26.27 du/acre		ML	Industrial	0.30
ROA	Medium Density Residential	2.43 du/acre		ML_IM	Industrial	0.30
RO	Medium Density Residential	2.79 du/acre		RO CR	Mixed Use	2.79 du/acre

The results of the Current Trends Scenario are summarized in Table 4.3. We compared the capacity for new households in the study area with the Round 5C new household projections and found that if trends continue, only 25% of the projected households in Owings Mills would fit, and only 50% of the projected jobs could be accommodated in the study area.

Table 4.3: Current Trends Scenario Capacity by TAZ

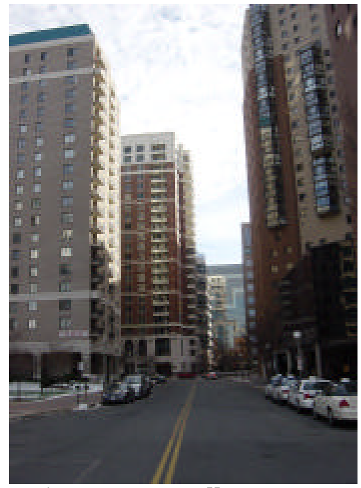
TAZ	New Household Capacity, Trends	Employment Capacity, Trends
425	189	250
426	204	62
427	0	138
428	0	8,702
429	0	743
430	246	3,469
432	57	0
433	80	469
434	75	401
435	130	954
436	0	0
440	51	0
483	1,453	181
484	0	3,650
493	715	267
498	213	61
510	14	341
511	0	497
512	64	71
Total	**3,491**	**20,256**

2. TOD Scenario

The Transit Oriented Development Scenario was developed to create a "Town Center" in Owings Mills that would improve access to the transit station, as well as allow for more of the projected households, population, and employment to fit inside this area. We used the Ballston TOD as a prototype development to help design this scenario. The Arlington County, Virginia Planning Department provided information to help develop a profile for the Ballston TOD. Appendix B summarizes the profile information for the Ballston area as well as other communities in the Baltimore-Washington region.

We realize that some of the development densities in Ballston are higher than much of what currently exists in Owings Mills. However, Ballston provides a good example of recent dense development centered on a subway stop.

This scenario focused on parcels immediately surrounding the Owings Mills transit station, as well as several parcels within one mile of the transit station. Figure 4-2 illustrates the location of these parcels.



Picture 4-1 - Ballston

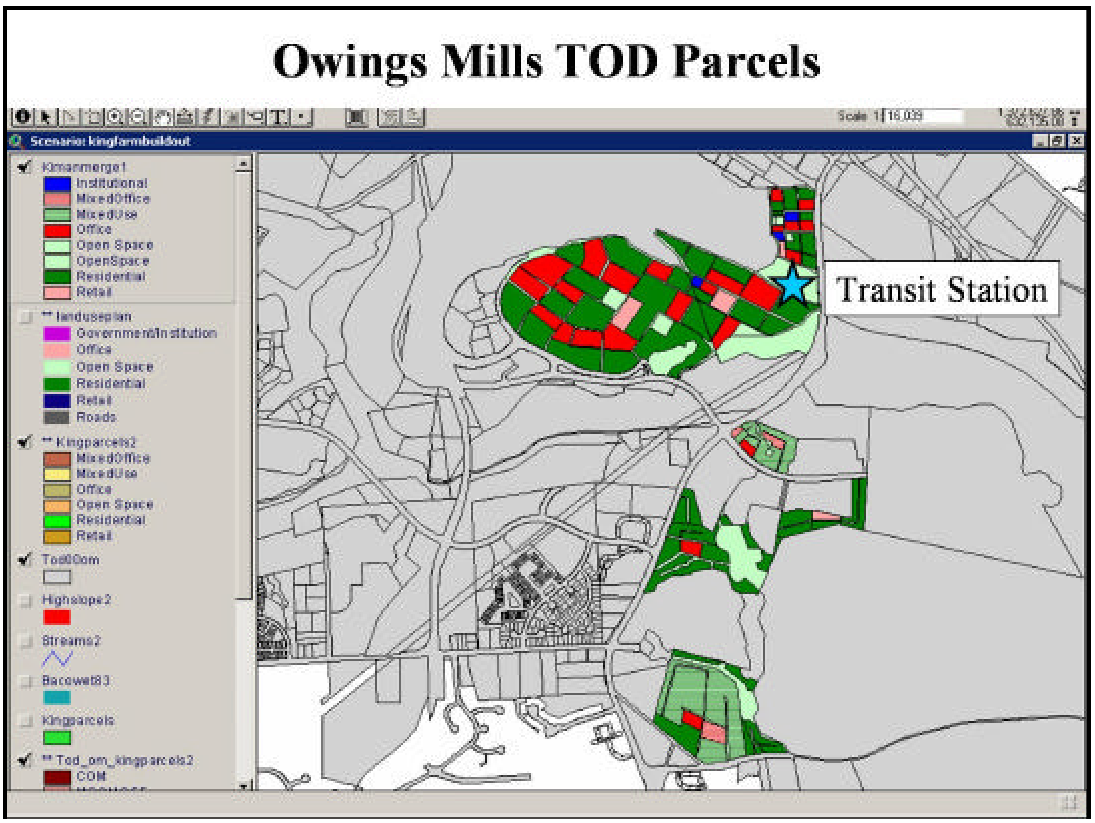


Figure 4-2 Owings Mills TOD Parcels

In this scenario, densities similar to those found in Ballston, Virginia were applied to the parcels immediately surrounding the transit station (see Pictures 4-1 – 4-3). This scenario also assumes the redevelopment of the Owings Mills Mall, which is adjacent to the transit station parking lot.

While we are unaware of any plans to redevelop the existing Owings Mills mall, it is very unlikely it will remain in its existing form 25 years from now. Therefore, for scenario purposes we assumed that it would be redeveloped.

The second portion of the scenario impacts parcels within a one-mile radius of the transit station. These parcels were "built out" using a mixed-use development profile, similar in land use mix and density to King Farm, a community in Rockville, Maryland. For these immediately surrounding parcels, a gross residential density of 9.52 dwelling units per acre was used and a gross FAR of 0.7 was applied to these areas. In the end, the net residential density was increased to 15 dwelling units per acre to account for environmental constraints.

Figure 4-3 gives specific information related to what each parcel's net residential and nonresidential densities were for the intensified TOD scenario.

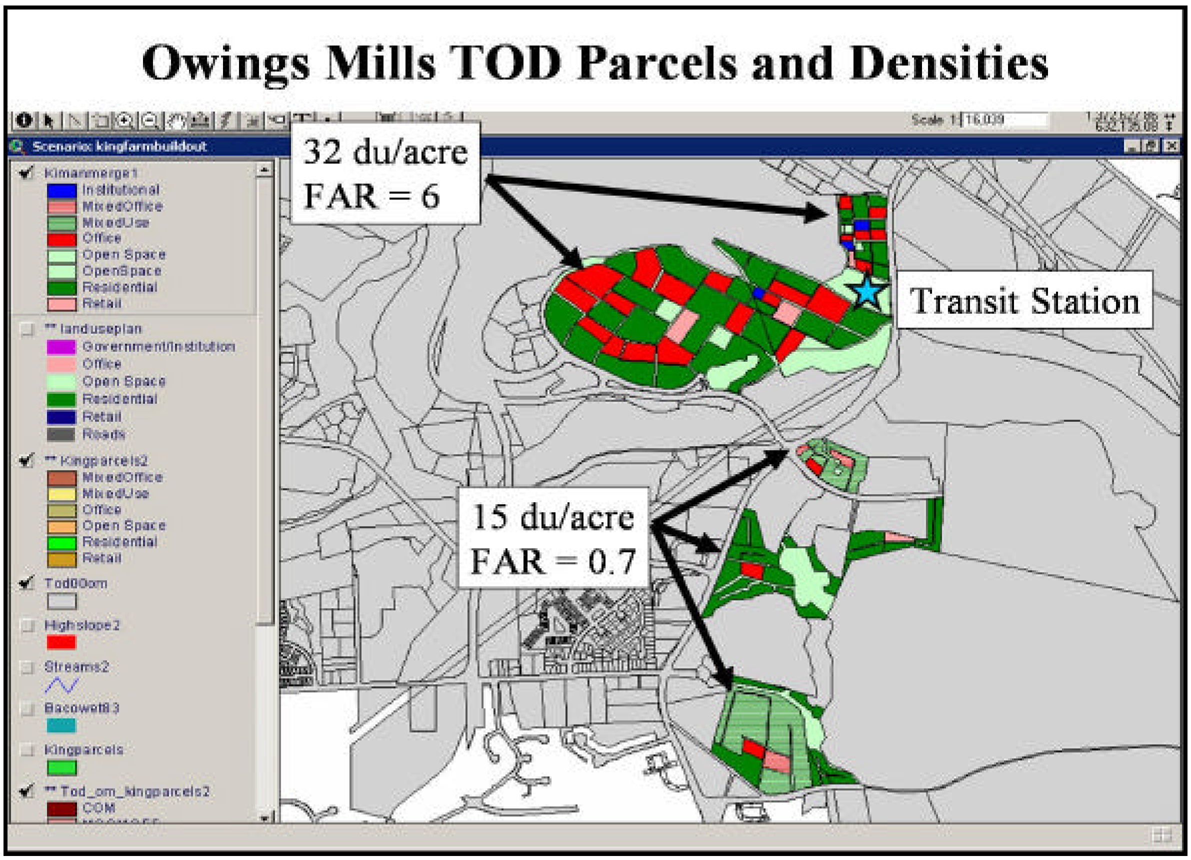


Figure 4-3 Owings Mills TOD Parcels

The result of applying these increased densities for the intensified TOD scenario increased the capacity for new households to 2/3 of the projected amount of households and increased the number of available jobs to 20,000 more than were projected in the Baltimore Metropolitan Council's Round 5C TAZ projections. This is shown in Table 4.4.

Table 4.4: TOD Scenario Capacity per TAZ

TAZ	New Household Capacity: TOD Scenario	Employment Capacity: TOD Scenario
425	189	250
426	204	62
427	0	12,996
428	0	8,702
429	2,799	35,212
430	246	3,469
432	57	0
433	80	469
434	75	401
435	130	954
436	0	0
440	51	0
483	1,453	181
484	1,539	3,440
493	715	267
498	213	61
510	14	341
511	0	497
512	64	71
Total	**7,829**	**67,374**

Picture 4-2 Ballston , Virginia

Picture 4-3 Residential Developments in Ballston

3. TOD & Mixed Use Scenario

Picture 4-4 – Mixed Use

The TOD and Mixed Use Scenario is the most comprehensive scenario for the study area, meaning there are more parcels affected and they are more evenly distributed throughout the study area. This scenario includes all Tier 1 parcels and some Tier 2 parcels. It "builds out" these parcels at a residential and nonresidential density similar to that of the King Farm project in Rockville, MD (one of the profile projects). See picture 4-4.

A gross residential density of 9.52 dwelling units per acre and a gross FAR of 0.7 were applied to these areas. It also follows a similar mix of land uses as King Farm. Figure 4-4 shows the key parcels affected by this scenario.

Picture 4-5 - Rosewood

This scenario builds on the TOD Scenario, and includes all of the parameters in that scenario. This scenario focuses on the remaining large underutilized or undeveloped lots in the study area, as well as one major redevelopment site. This site is the Rosewood Mental Hospital Campus in the East/Northeast quadrant of the study area (see Picture 4-5). This is an underutilized parcel and much of the property is made up of vacant structures and undeveloped land. Several other large, old mental hospitals around Maryland have been or are being redeveloped.

This scenario increases the new household capacity and employment capacity so that the Owings Mills Growth Area can accommodate the entire Round 5C projection. Table 4.5 illustrates this increase.

This analysis shows that, with some alternative development patterns, the growth projected for Owings Mills in Round 5C can be accommodated within the Growth Area. Further, this can have many positive impacts at the site scale, as well as at the growth area, County, and regional level.

Table 4.5: TOD & Mixed Use Scenario: Household and Employment Capacity

TAZ	NHC Mixed Use/Ballston Scenario	Employment Capacity, King Farm Scenario
425	249	250
426	302	62
427	0	12,996
428	481	9,747
429	0	35,212
430	1,526	5,642
432	77	0
433	125	469
434	91	401
435	145	3,783
436	5,203	5,452
440	72	0
483	1,616	3,068
484	2,564	3,440
493	1,276	2,543
498	492	1,654
510	11	341
511	0	497
512	67	71
TOTALS	**14,297**	**85,628**

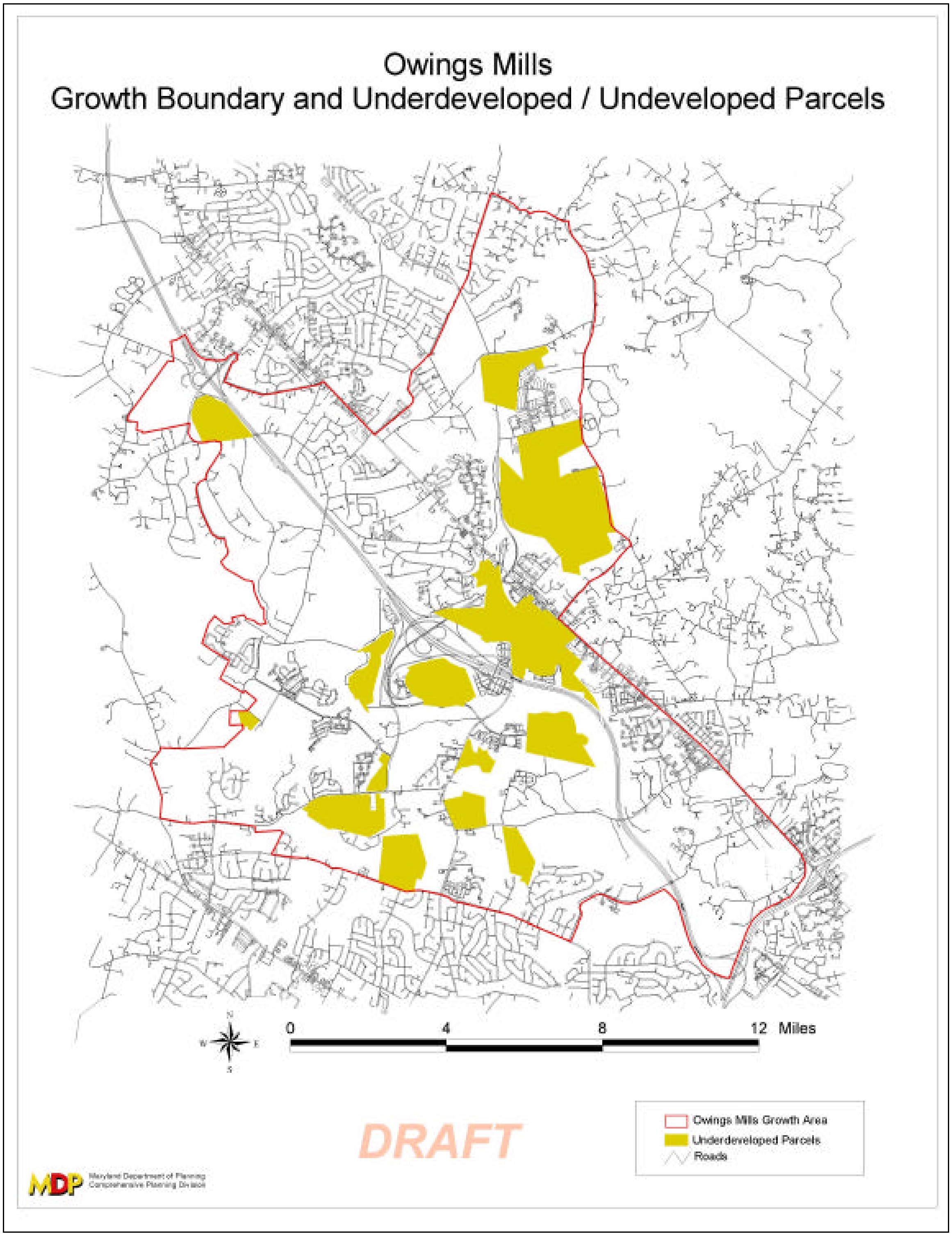

Owings Mills
Growth Boundary and Underdeveloped / Undeveloped Parcels
N
W
E
S
0
4
8
12 Miles
Owings Mills Growth Area
Underdeveloped Parcels
Roads
DRAFT
MDP
Maryland Department of Planning
Comprehensive Planning Division

Figure 4-4

V TRANSPORTATION AND EMISSION IMPACTS

A. Introduction of Models

The Maryland Department of Planning's Transportation Planning Unit provided both transit and air quality impacts analyses on macro and micro levels for the Owings Mills Transit Oriented Development Study. The Baltimore Metropolitan Council's (BMC) Four Step Travel Demand Model (macro scale) was incorporated to forecast regional travel demand including trip generation, trip distribution, mode choice, and trip assignment. This was used to simulate transportation demand, vehicle flow, and mode choice. The Smart Growth Index (SGI) Model was used at the micro-scale. It used key indicators in various scenarios to measure transportation, land-use, and environmental characteristics for the Owings Mills TOD area. These two models were utilized in the study to determine potential benefits to transit and air quality within the Owings Mills TOD study area. Figure 5-1 (on the following page) represents the study areas used in the BMC and SGI transportation models.

B. Regional Travel Model Runs for Potential Macro Benefits

To assess transit and air quality impacts of transit oriented development, MDP compared the potential reductions based on different development scenarios using the Baltimore Regional Travel Demand Model and the Center for Clean Air Policy's Greenhouse Gas (GHG) emission methodology.

The first scenario, Current Trends, projected growth to 2025 assuming current zoning and the Round 5C TAZ Projections. This served as a baseline for MDP's analysis.

The second scenario, TOD, included three Transportation Analysis Zones (TAZ's) (See Figure 5-1). These TAZ's, located adjacent to the Owings Mills Metro Station, have revised capacity for intensified future growth. This scenario added 4,338 households and 47,117 jobs over the Trends Scenario. Development that did not fit into the TOD area was allocated evenly throughout Baltimore County.

The third scenario, Density Modified TOD, adds higher population density to the second scenario. Specifically, the code used in the Regional Travel Demand Model was changed to a center city density from a suburban density. Since the regional model dose not fully explain travel and air pollution effects of micro-scale site design, pedestrian friendly walking environment and land use diversity, MDP employed two methodologies to examine their effect: Increasing Density in the regional model and use of the Smart Growth Index Model. The land use pattern of center city, which has more households per acreage, is assumed as a substitute of all micro factors to capture their effects in the regional model.

NOTE: All BMC Four Step Regional Travel Demand Model Scenarios occurred at a scale of three TAZ's. All scenarios build upon the land use scenarios described in Chapter IV.

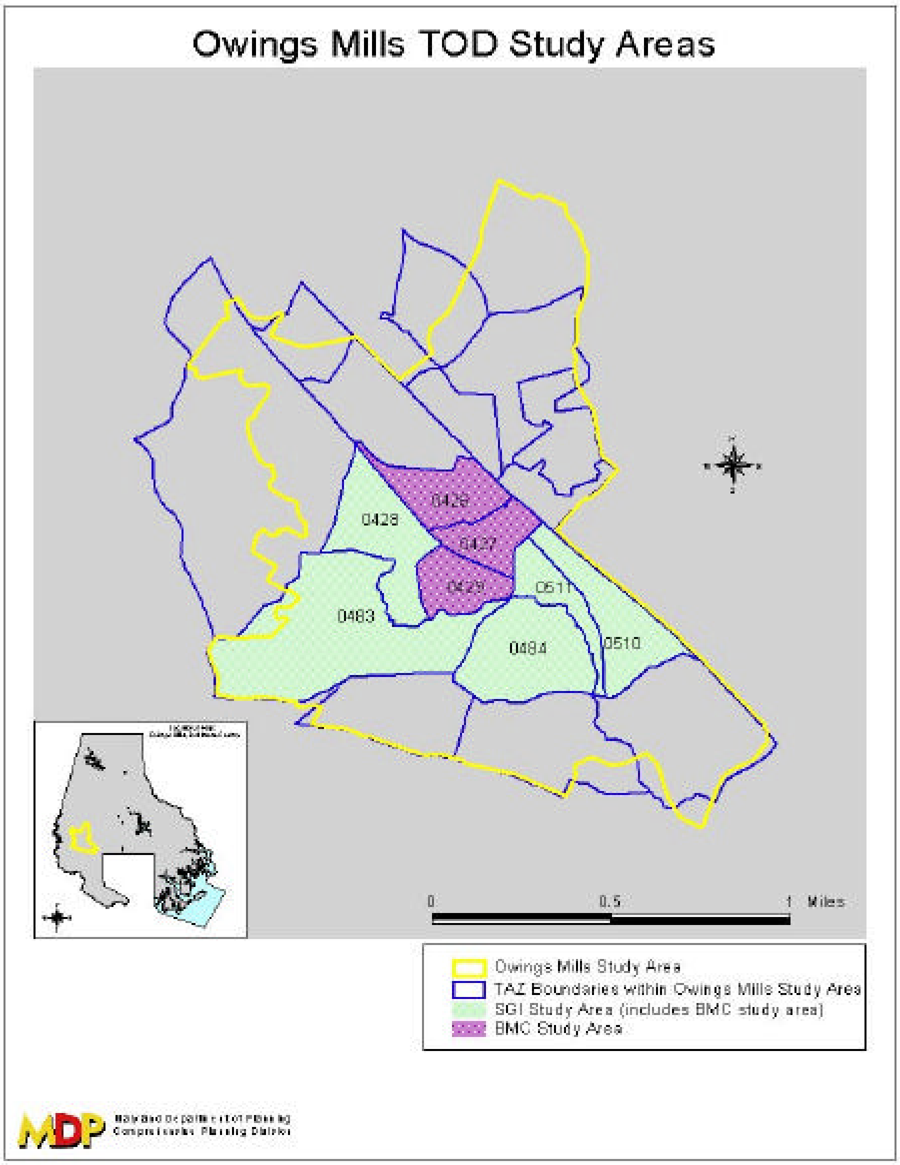


Figure 5-1 Owings Mills TOD Study Areas

Table 5.1 BMC MODEL RESULTS

				Density Modified TOD		
Site – 3 TAZ's	VMT	152,266	230,790	213,947	61,681	40.5%
	VMT	24,050,400	23,969,000	23,797,300	-253,100	-1.1%
	Transit Trips	65,220	66,370	67,590	2,370	3.6%
Baltimore County	Motorized Trips	2,823,701	2,826,439	2,828,427	4,726	0.2%
	Non- Motorized Trips	261,550	261,071	309,709	48,159	18.4%
	VMT	71,950,000	71,789,000	71,523,000	-427,000	-0.6%
	Transit Trips	322,960	324,910	326,730	3,770	1.2%
Baltimore Region	Motorized Trips	9,163,000	9,161,403	9,160,000	-3,000	-0.03%
	Non- Motorized Trips	1,241,000	1,240,872	1,246,000	5,000	0.4%

C. Results and Implications: BMC Model

These findings are indicated in Table 5.1:

- Site VMT showed variation due to a household-to-job imbalance at the site level. NOTE: The focus area of the study is considered a job center, so the original projection already contained a pre-existing household-to-job imbalance. After considering the change in density code (suburban to center city), site VMT drops from the original TOD run.
- Density Modified TOD showed VMT reduction of 1.1% and 0.6 % at the county and regional level, respectively.
- As expected, transit trips increased 3.6% and 1.2% at the county and regional level, respectively.
- Non-motorized trips, mainly due to density increases, significantly increased 18% in Baltimore County

The benefits from the avoidance in motorized vehicle use by residents of this development and a reduction in the use of motorized vehicles near an existing transit station are significantly quantifiable at the county level.

D. Smart Growth Index Model Runs for Potential Micro Benefits

Smart Growth Index (SGI) is a GIS-based tool that was created to model "snapshot sketches" of different community planning scenarios (Criterion Planners/Engineers, 2002). SGI was used in this study to evaluate the potential micro scale benefit of the Density Modified TOD scenario with the existing condition of the site. The SGI Model runs were based on three TOD TAZ's and five adjacent TAZ's. These eight TAZ's made up the SGI study area. Table 5-2 (Below) provides the results of two SGI sketches.

E. *Results and Implications: SGI Model*

These findings are indicated in Table 5.2:

- The Density Modified TOD scenario generally showed fewer impacts in the areas of land use, housing, employment, travel, and air quality emission except household-job balance and street connectivity. The model indicated room for further improvements to the TOD Scenario. These improvements could include greater connectivity and enhanced transportation choice within the TOD Scenario. This scenario better utilizes transit and indicates air quality benefits resulting from the transit-oriented development.
- Although there is a higher imbalance between jobs and housed workers due to the nature of intensified transit oriented development, daily VMT per capita decreased by 1.9 – 2.9%. There was also a decrease in yearly air emissions per capita that ranged from 1.1% to 3.3%.
- These results appear to be due to an increase in non-motorized trips to meet the need of residents for greater connectivity and variety in transportation modes (walking, biking, etc.)

The SGI Model showed a decrease in air emissions in the study area (8 TAZ's) (See Figure 5-1). It should be noted that the effects of design, density, and diversity within the development area are not accounted for in the BMC Four Step Travel Demand Model (regional model). The Smart Growth Index Model was highly effective at evaluating the potential micro scale benefits of a small-scale site and in defining indicators to be improved to maximize the potential benefits of TOD development.

F. *Center for Clean Air Policy (CCAP) Emission Analysis*

Staff at MDP worked with the Center for Clean Air Policy (CCAP) to determine possible Greenhouse Gas (GHG) emission reductions for the Owings Mills TOD project. Specifically, CCAP used MDP's VMT reduction data (based on the BMC Four Step Regional Model) to calculate GHG reductions. The results can be found in Table 5.3. NOTE: Scenario I (Current Trends) was used as the baseline in this analysis. The complete CCAP analysis can be found in Appendix E.

Table 5.2 SMART GROWTH INDEX MODEL RESULTS

	Description	**2000 Conditions**	**2025 TOD Scenario**		**Percent Change**
Population density	Persons (residents and employees) per acre	9.33	26.18	16.85	180.6%
Land Use mix	Proportion of dissimilar land uses among a grid of one-acre cells	0.31	0.33	0.02	6.5%
Multi-family 5+ units housing share	Percent	54	70	16.00	29.6%
Housing proximity to transit	Avg. distance to a stop (ft.)	7,256	5,675	-1581.00	-21.8%
Jobs/housed workers balance	Jobs/workers	2.15	5.52	3.37	156.7%
Open space	Percent total land area	23	24	1.00	4.3%
Street centerline distance	Total street centerline dist (ft.)	427,037	436,161	9124.00	2.1%
Sidewalk completeness	% of street frontage w/ sidewalk both sides	48	80	32.00	66.7%
Pedestrian route directness	Network distance/airline distance	2.22	2.37	0.15	6.8%
Street network density	Street centerline mi. / sq. mi.	13.1	13.4	0.30	2.3%
Street connectivity	Ratio of intersections vs. intersections and cul-de-sacs	0.75	0.74	-0.01	-1.3%
Home-based vehicle trips	VT/day/capita	2.4	2.3	-0.10	-4.2%
Non home-based vehicle trips	VT/day/capita	1.1	1	-0.10	-9.1%
Home-based vehicle miles travel	VMT/day/capita	17.4	16.9	-0.50	-2.9%
Non home-based vehicle miles travel	VMT/day/capita	5.4	5.3	-0.10	-1.9%
Carbon monoxide (CO)	lbs/yr/capita	469	457	-12.00	-2.6%
Hydrocarbon (HC)	lbs/yr/capita	61	59	-2.00	-3.3%
Oxides of nitrogen (NOX)	lbs/yr/capita	42	41	-1.00	-2.4%
Carbon dioxide (CO2)	lbs/yr/capita	13,839	13,682	-157.00	-1.1%

Table 5.3: GHG Reductions from Owings Mills: Scenario II, III vs. Scenario I (Baseline or Trend)			
Scenario II **TOD**	**VMT Reduction Per day**	**$MTCO_2$ Per day**	**Impact on regional VMT**
Site Level – 3 TAZ's	**78,525**	**35.6**	**+0.11%**
Baltimore County	**-81,400**	**-36.9**	**-0.11%**
Region	**-161,000**	**-73.0**	**-0.22%**
Scenario III **TOD w/ Increased Density**	**VMT Reduction Per Day**	**$MTCO_2$ Per Day**	**Impact on regional VMT**
Site Level	**61,681**	**28.0**	**+0.09%**
Baltimore County	**-253,100**	**-114.8**	**-0.35%**
Region	**-427,000**	**-193.7**	**-0.59%**

$MTCO_2$ = metric tons of carbon dioxide

Note: Average passenger vehicle GHG emissions based on US DOE, *Transportation Energy Data Book*, Tables 7.1, 7.2. The 1.2% percent increase in regional transit trips is assumed to be accommodated by existing transit service, and therefore have no marginal emissions impact.

The analysis of GHG reductions from the Owings Mills Project presented above represents an important first cut at assessing potential emission credit generation. It provides an order-of-magnitude sense of potential GHG emissions reductions available by concentrating mixed-use development near an existing transit station. In order to determine the actual GHG reductions from the project it would be necessary to establish a monitoring and verification methodology and effort. This could be accomplished using transit rider ship data, passenger surveys, and traffic count data for all modes, including walking and biking.

Key questions include:

- How effective is the proxy of Baltimore City to estimate density at Owings Mills?
- Where would development have gone without the TOD project? (Atlantic Steel and Digital Harbor analyses) (See Table 5.4 for Infill or Greenfield comparison)
- Can modeling of non-motorized trips be improved? (E.g., how to capture intra-zonal trips)
- What are the marginal GHG emissions from a transit trip? (E.g., what level of rider ship increase would require increased transit vehicle trips?

Table 5.4: Infill vs. 'Greenfield' Developments *

Location	Description of TOD / infill site	VMT Reduction	Emissions Reduction
Atlanta, GA	**138-acre Brownfield, mixed-use development project**	**14 - 52%**	**37 - 81% NOx** **293 - 316% VOC**
Baltimore, MD	**400 households and 800 jobs on waterfront infill development**	**55%**	**36% VOCs** **40% NOx**
Dallas, TX	**400 housing units and 1500 jobs located 0.1 miles from the Dallas Area Rapid Transit (DART)**	**38%**	**43% VOC** **48% NOx**
Montgomery County, MD	**Infill site near major transit center**	**42%**	**31% NOx**
San Diego, CA	**Infill development project**	**52%**	**42% NOx**
West Palm Beach, FL	**Auto-dependent infill project**	**39%**	**28% NOx**

G. Limitations of Regional Model

Two of the transportation models' calculations derived in the Owings Mills TOD study were conflicting. For example, the BMC Regional Model showed an increase in VMT at the site level (3 TAZ's), whereas the SGI model showed a slight decrease in VMT in the study area (8 TAZ's). In another case, the CO_2 emissions between the SGI model and CCAP model are drastically different due to calculations based on VMT for the Density Modified TOD Scenario. (Note: A conversion to metric tons was completed on the SGI figure for comparison, See Formula Below) This formula shows the limitation of the regional model's attempt to explain travel and air pollution effects on the micro scale (three TAZ's) of the Owings Mills project.

Formula: ((SGI Model Figure)/Tons * .9072 (metric ton) / days in year) * Capita

((-157)/2000 *.9072 / 365) * 6963 = **-1.36 MtonCO_2 / day**

SGI Emissions = -1.36 MtonCO_2 / day
CCAP Emissions = 28.0 MtonCO_2 / day

This reiterates the shortcomings of the regional model when working in a significantly smaller study area. Different types of models and different scales are both indications that this type of analysis needs some additional work.

APPENDIX A

Existing Conditions and Development Capacity

OWINGS MILLS

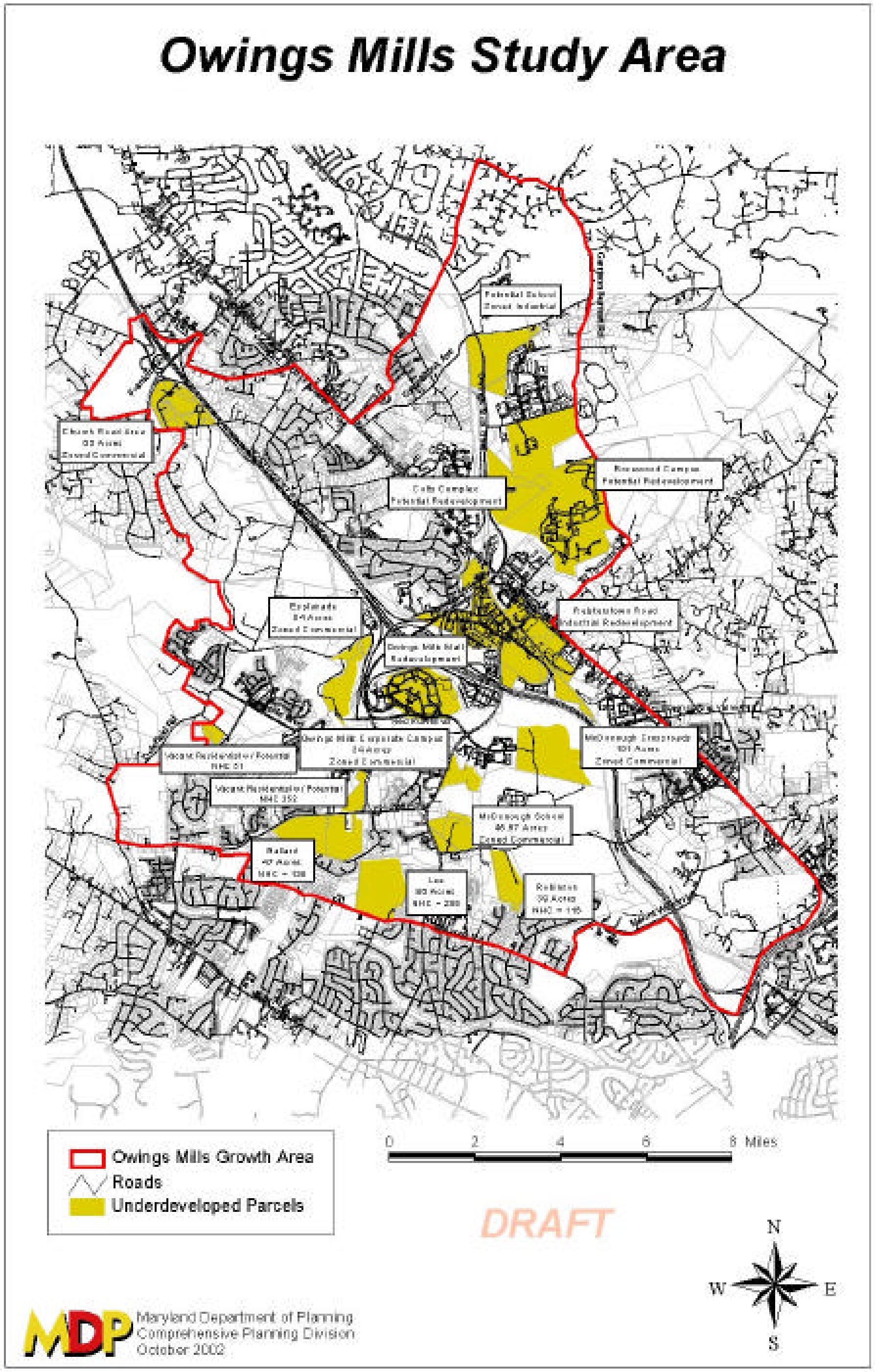
Existing Conditions and Development Capacity

Overview of Work to Date

- MDP Enhanced Parcel Database for Baltimore County
- County Data – Parcels, Land Use, Roads
- Input from the Project Team about the Data
- Field Work

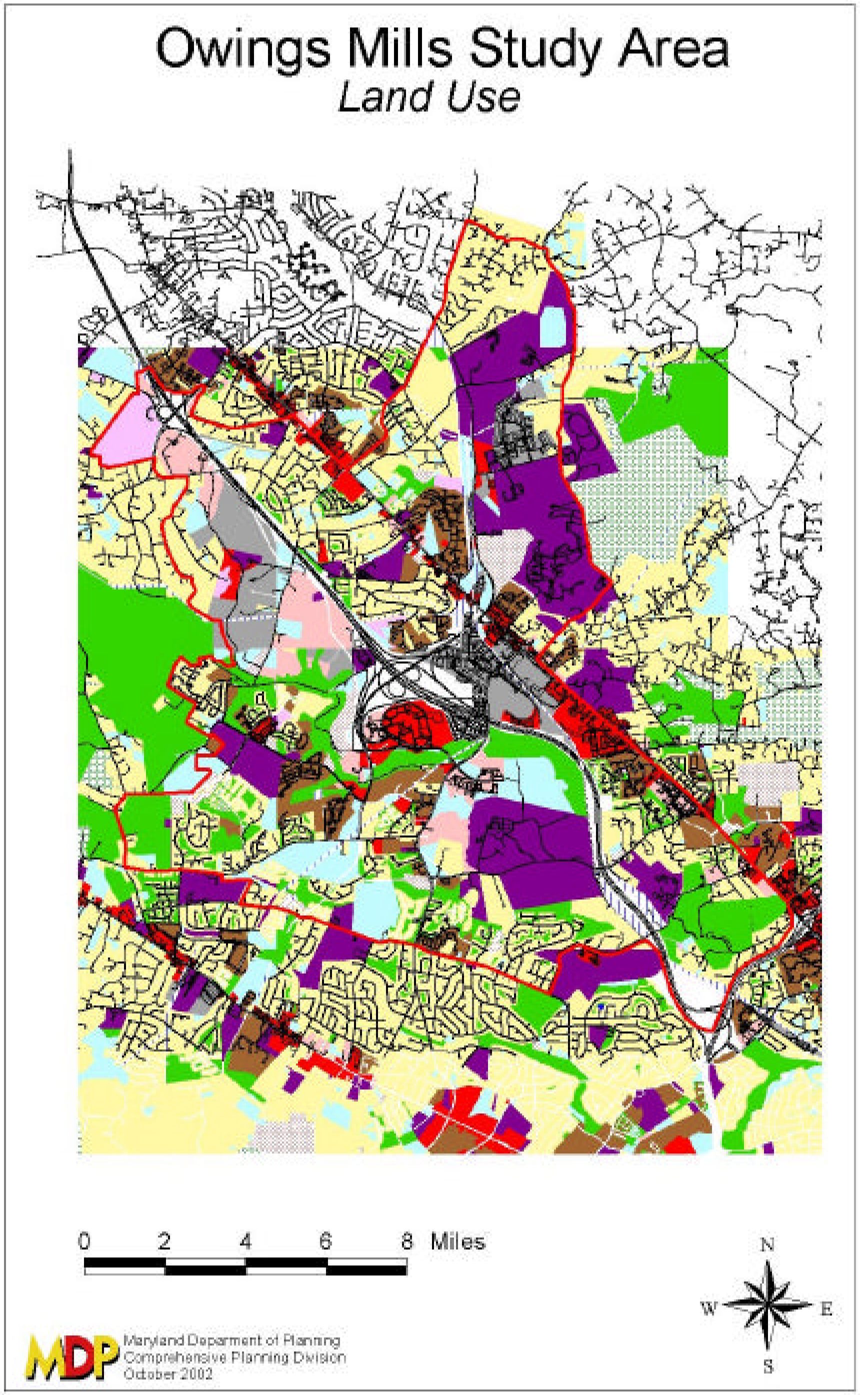
Background and Trends

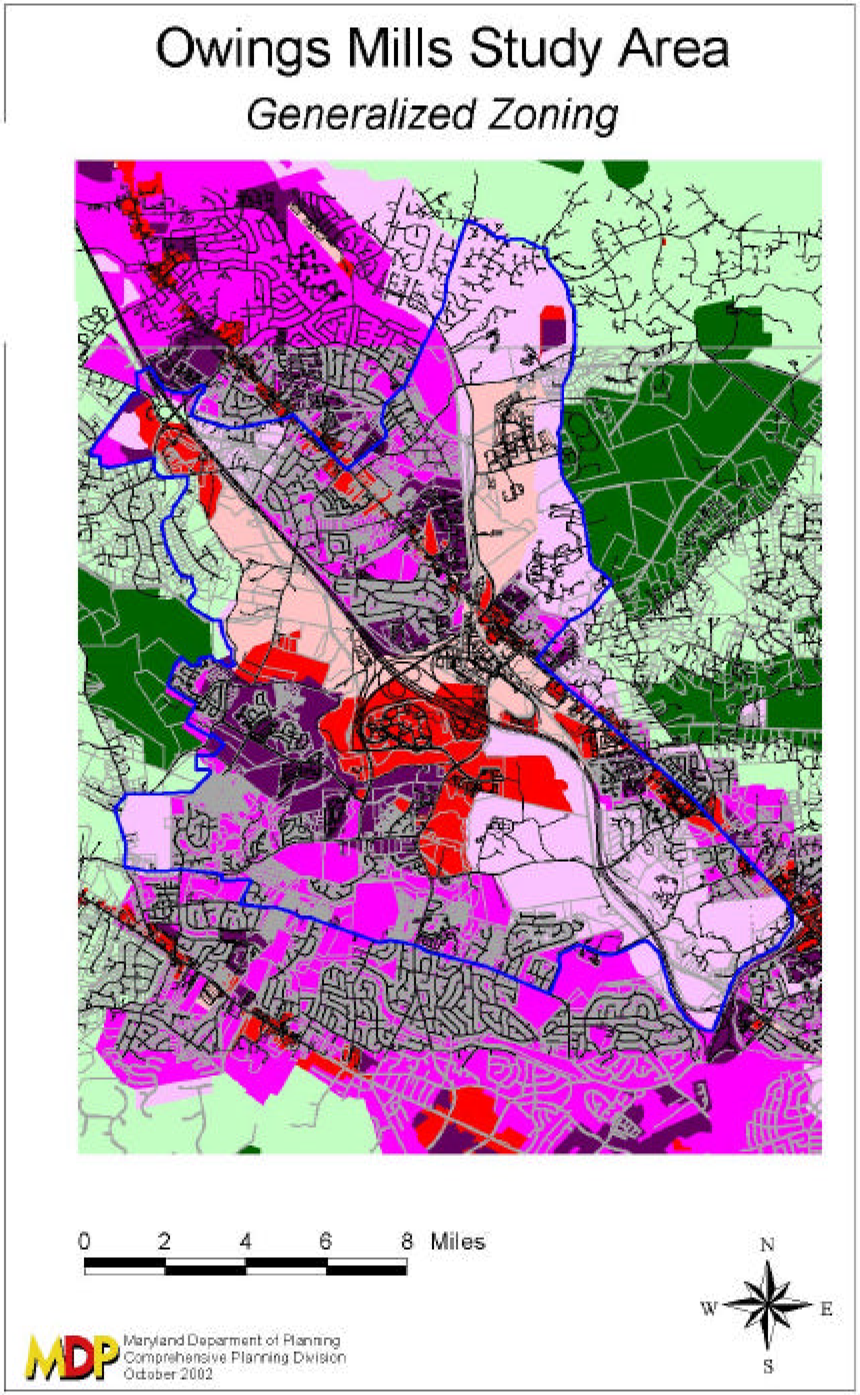
- Base Maps



- Owings Mills Growth Area
- Underdeveloped Parcels

Baltimore County Land Use

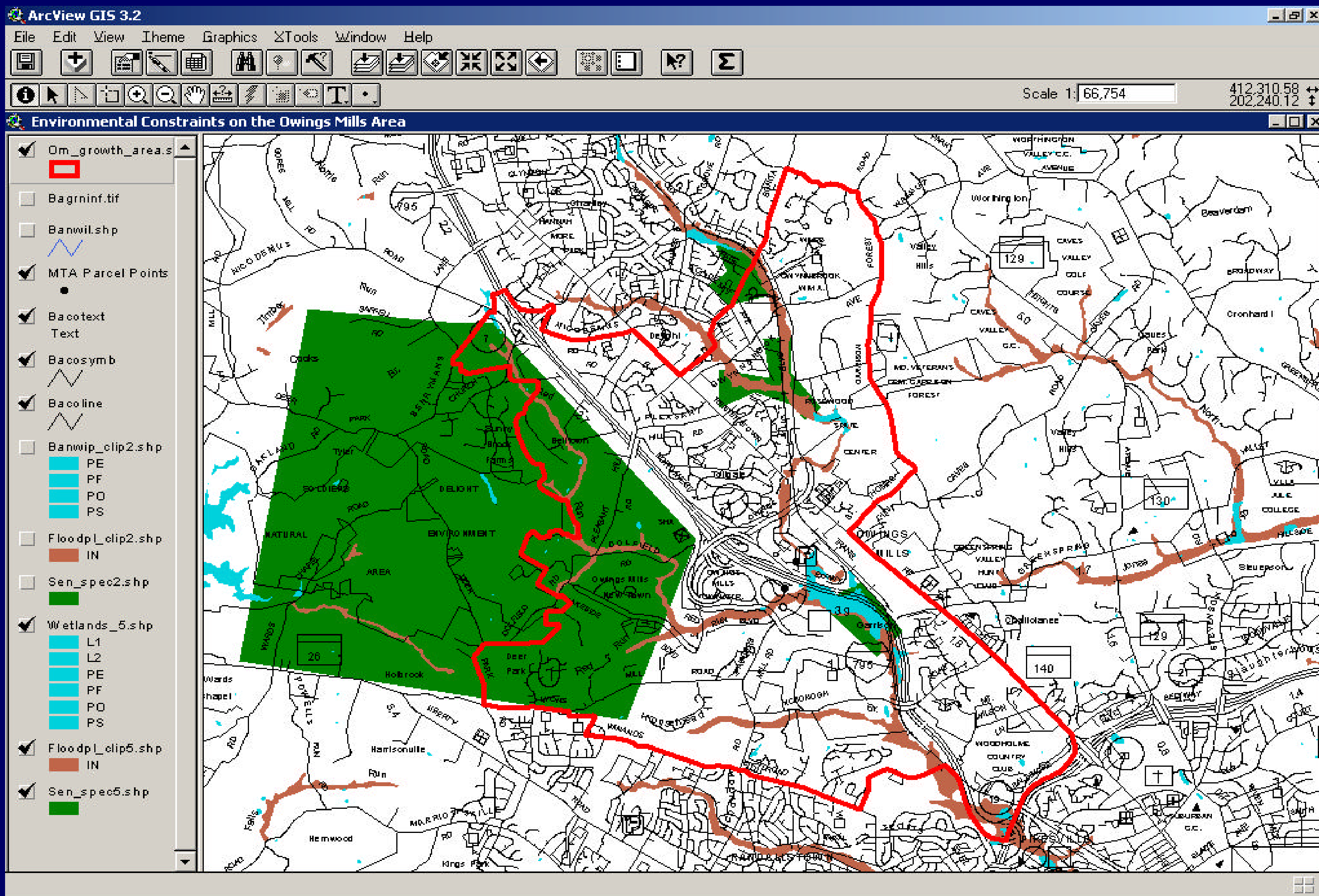




Baltimore County Zoning

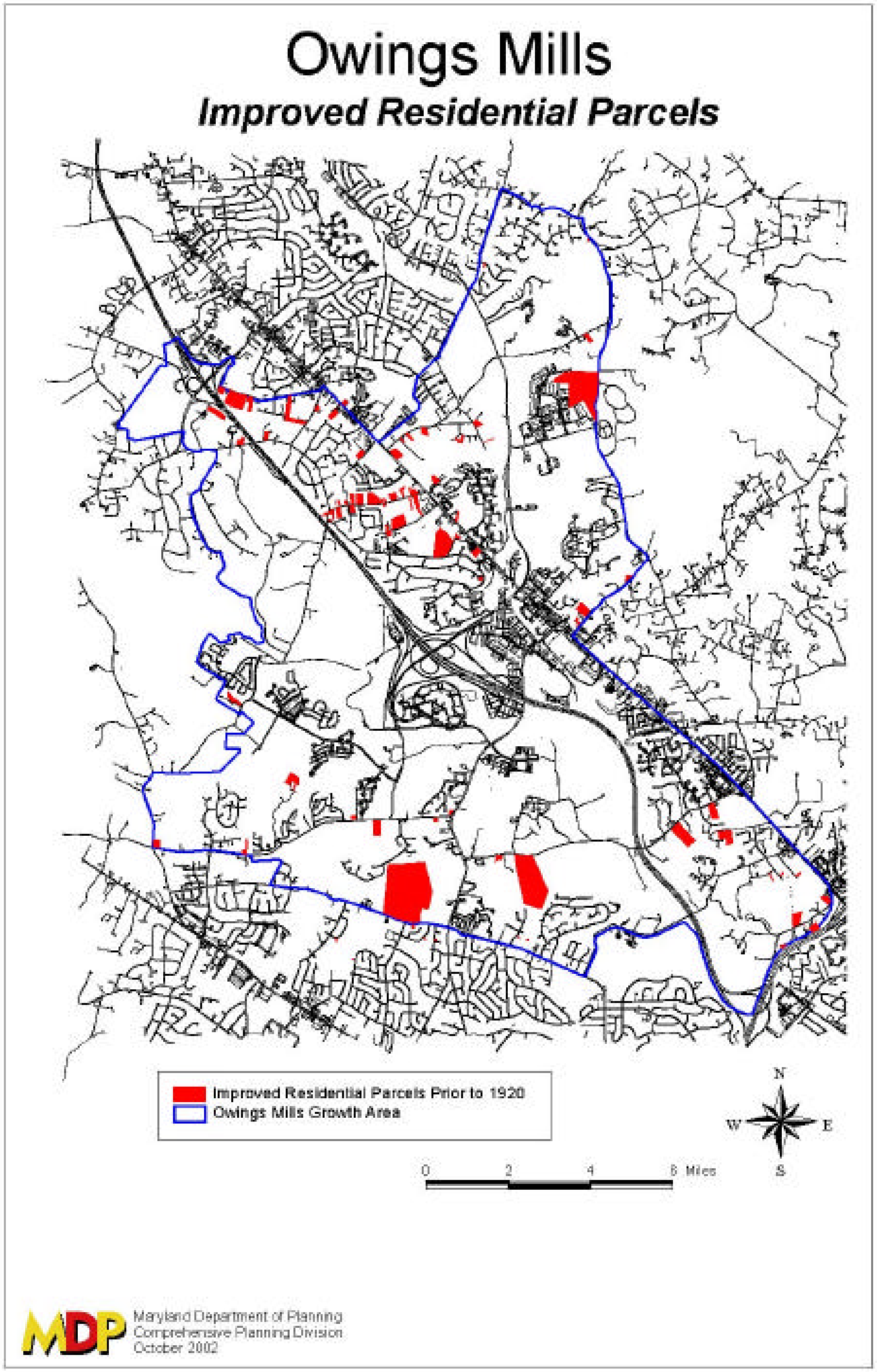
Owings Mills Study Area
Roads
Generalized Zoning
COMMERCIAL
INDUSTRIAL
LEAST PROTECTIVE
LOW DENSITY RESIDENTIAL
MEDIUM DENSITY RESIDENTIAL
MOST PROTECTIVE
MODERATELY PROTECTIVE
HIGH DENSITY RESIDENTIAL

Environmental Constraints

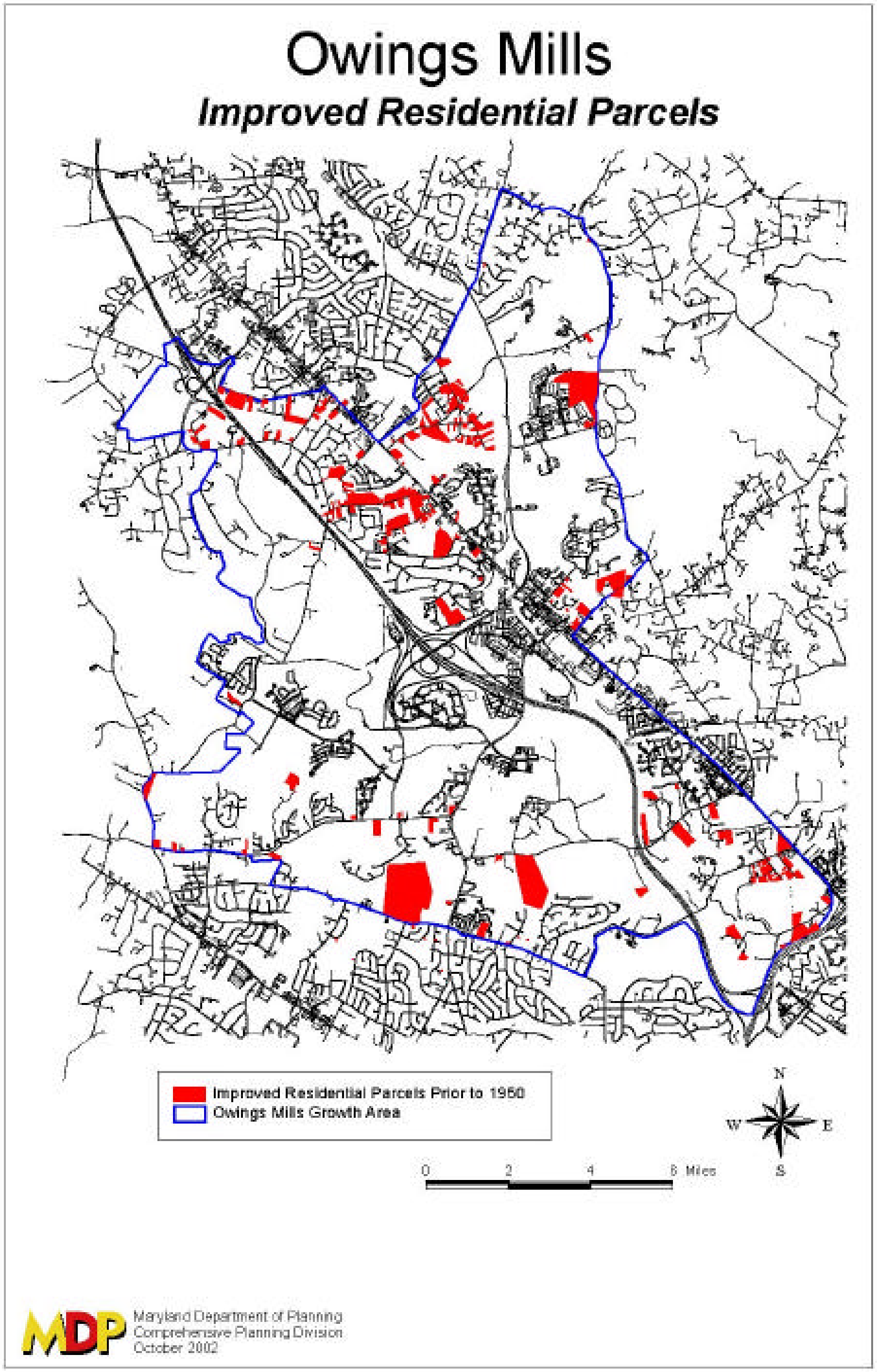


Background and Trends

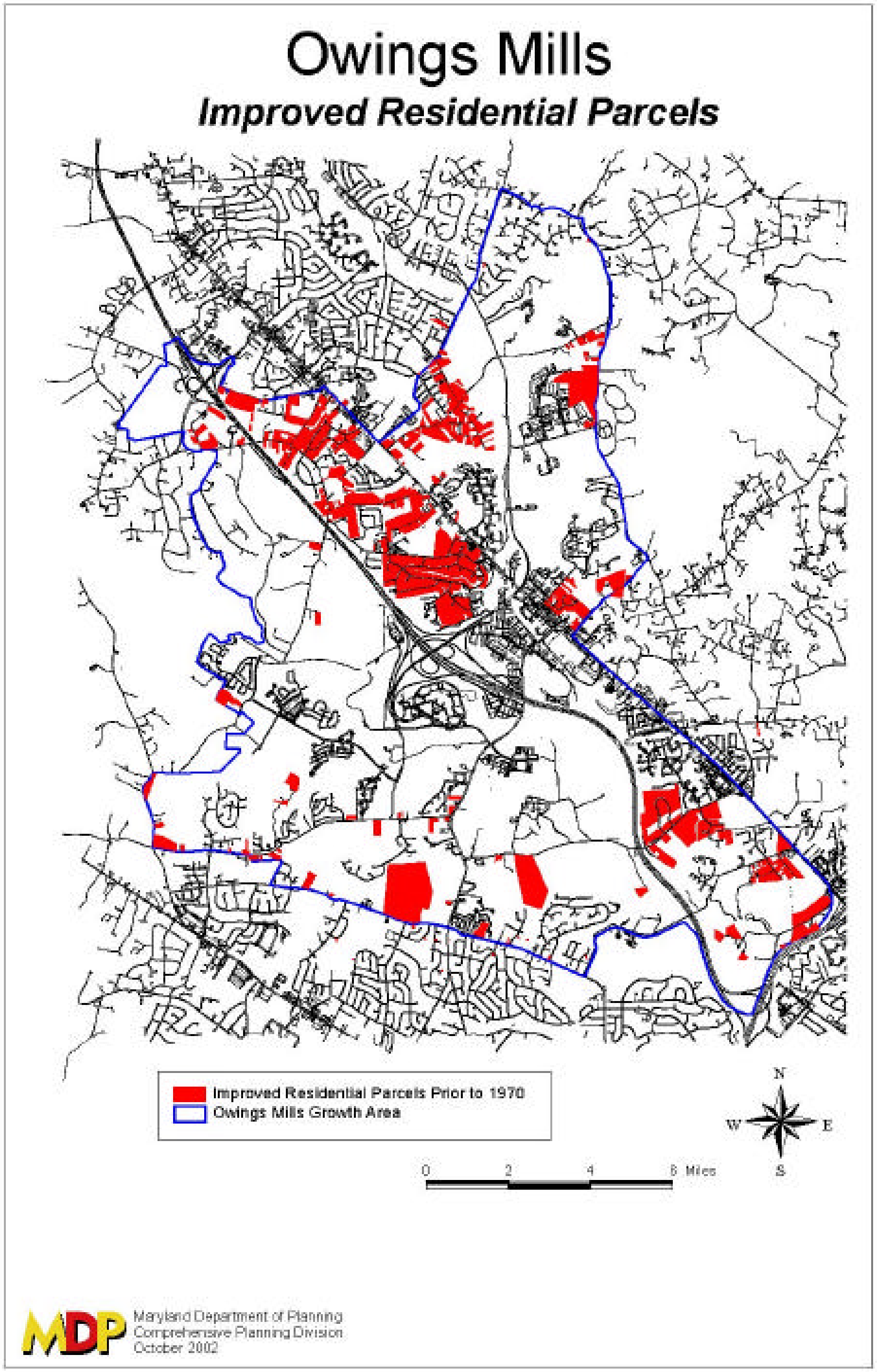
- Base Maps
- Development Over Time Map Series



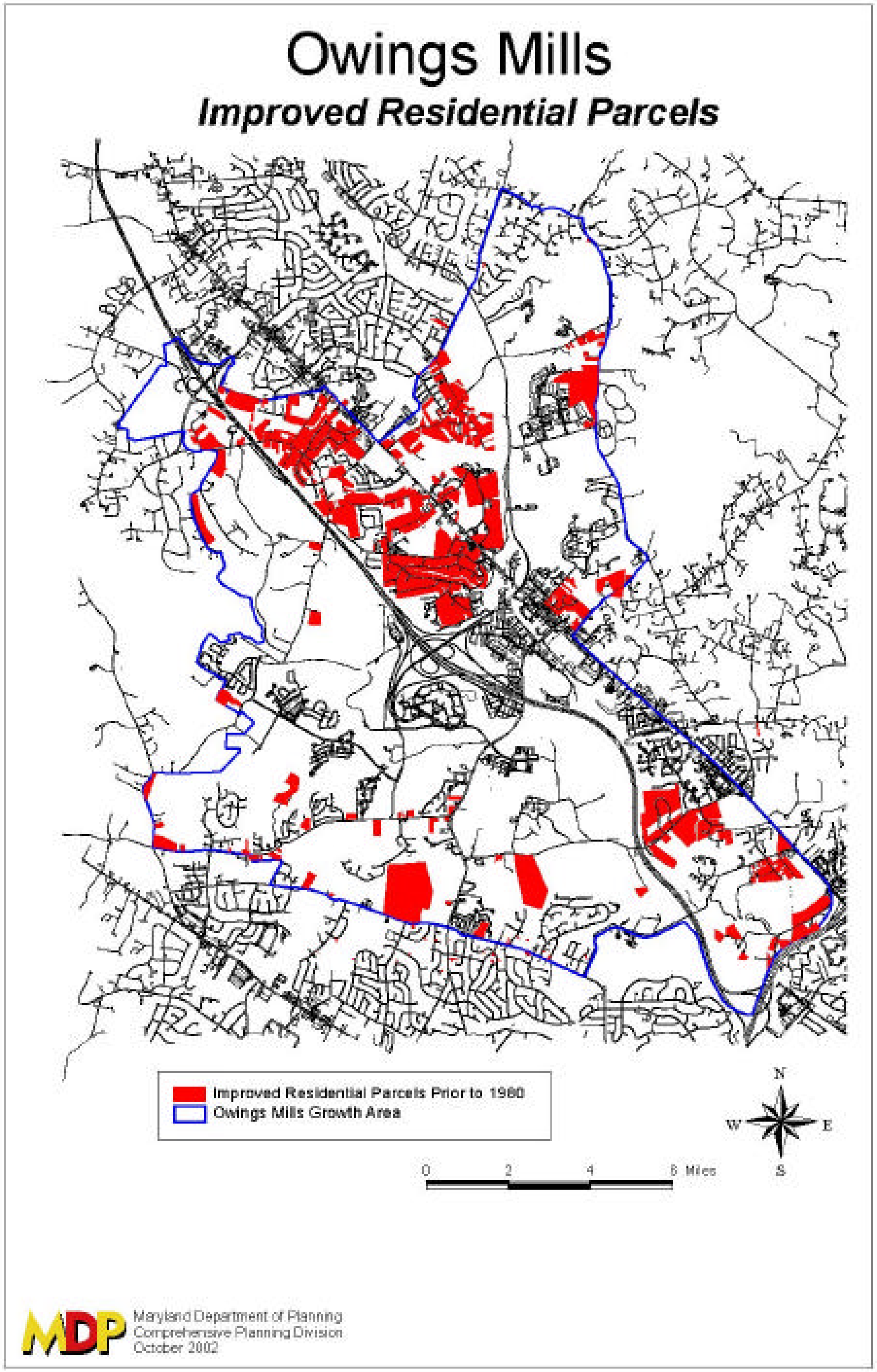
Improved Residential Parcels Prior to 1920



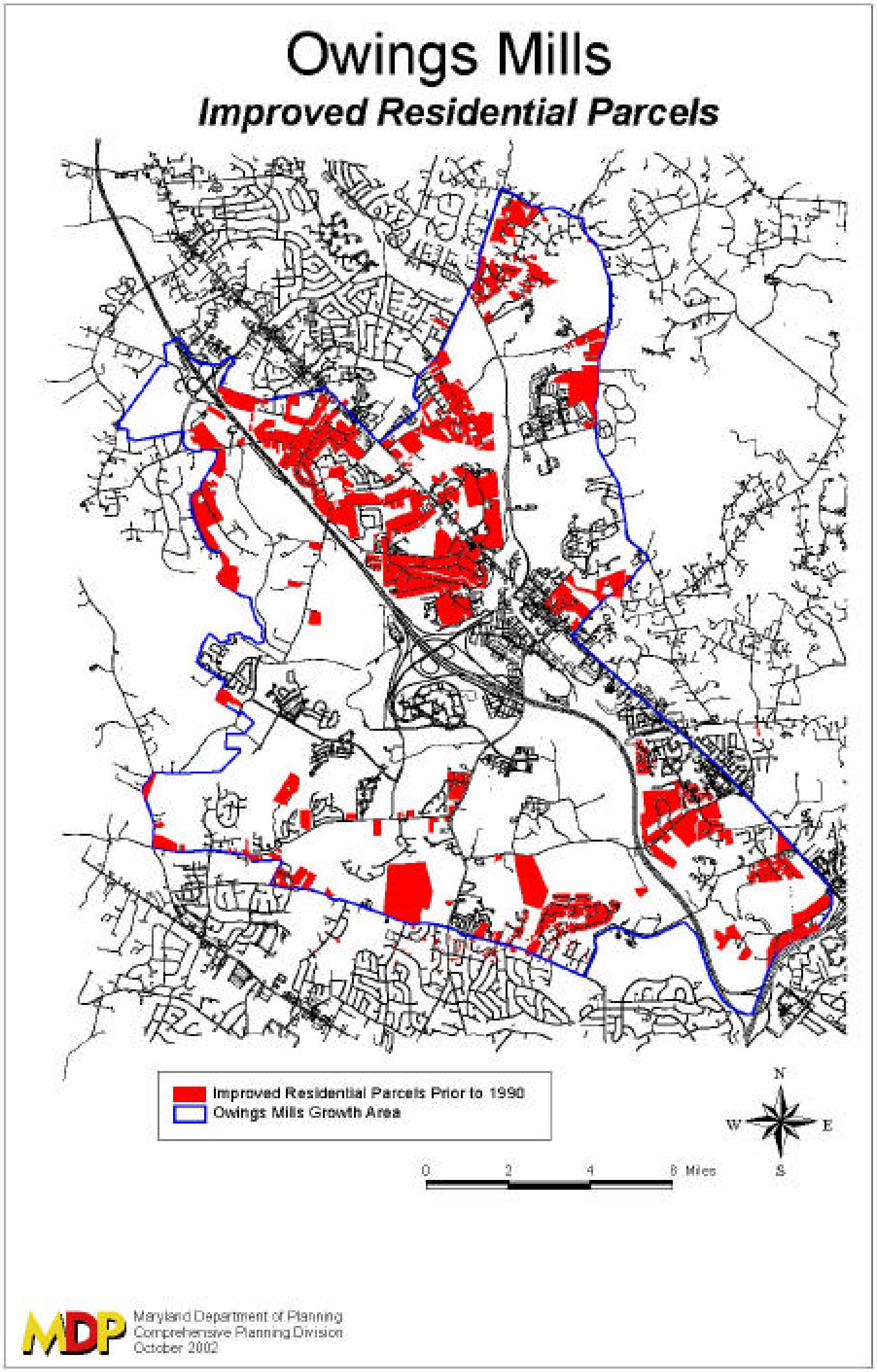
Improved Residential Parcels 1921 to 1950



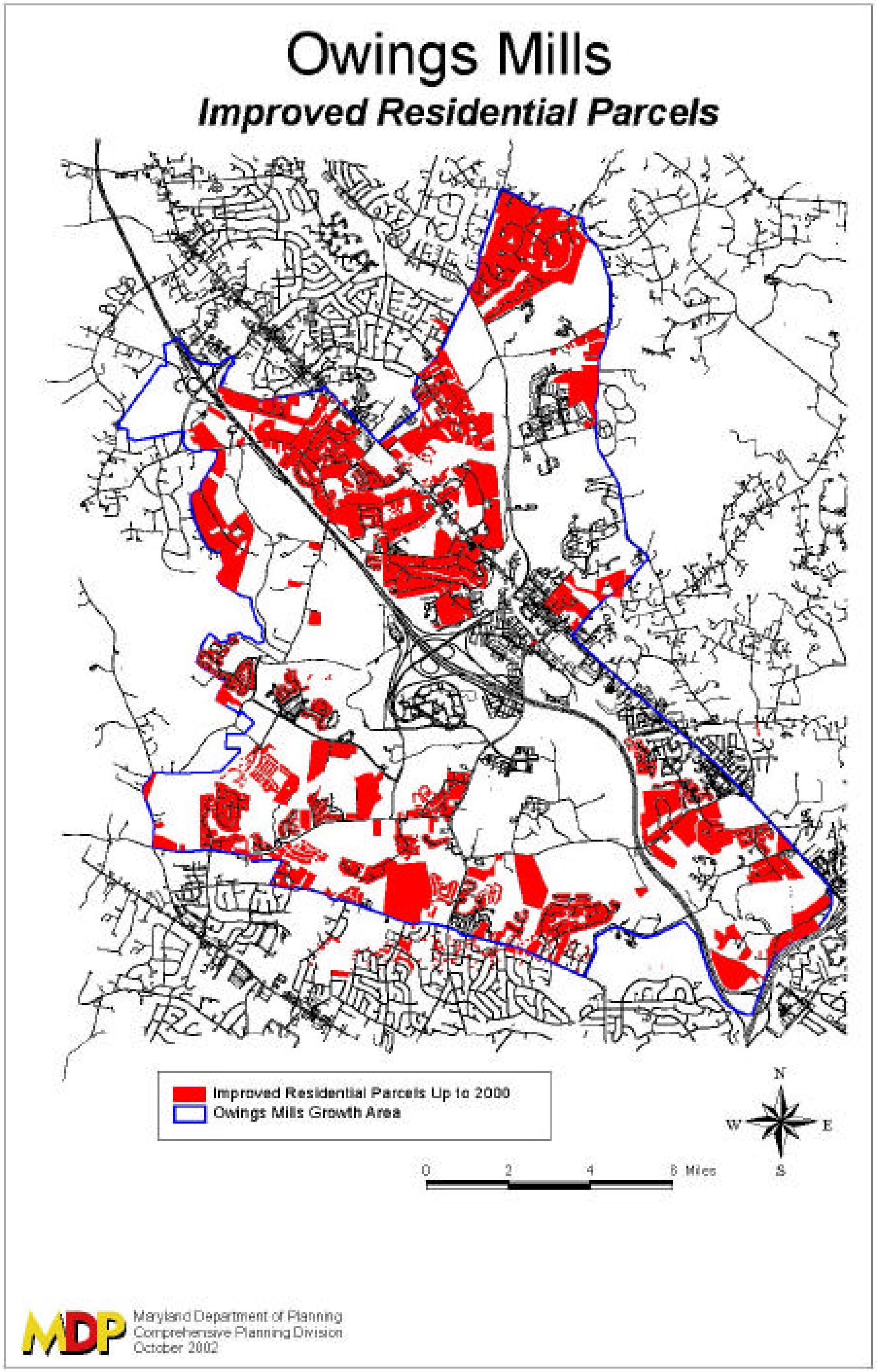
Improved Residential Parcels 1951 to 1970



Improved Residential Parcels 1971 to 1980



Improved Residential Parcels 1981 to 1990



Improved Residential Parcels 1991 to 2000

Background and Trends

- Base Maps
- Development Over Time Map Series
- A Few Photos of Owings Mills

Residential Development

Retail

New Mixed Use

T. Rowe Price

T. Rowe Price

Background and Trends

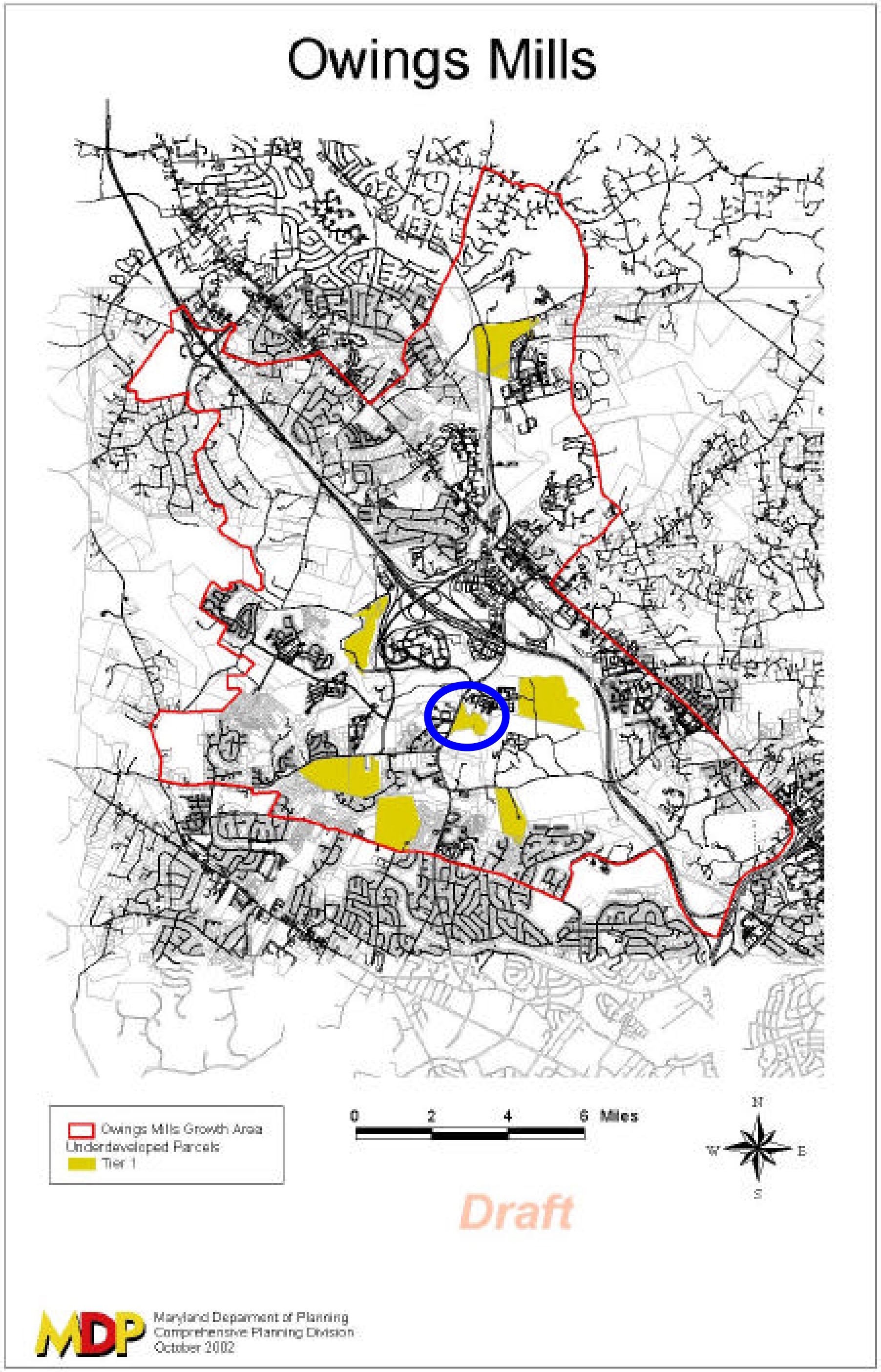
- Base Maps
- Development Over Time Map Series
- A Few Photos of Owings Mills
- TAZ Projections
- New Household Capacity

Owings Mills Growth Area - General Projection/Capacity Figures

TAZ	Population Projection to 2025 by TAZ *	Employment Projection to 2025 by TAZ	Household Projection to 2025 by TAZ	Capacity by TAZ	Capacity by TAZ**	Acres of TAZs
425	179	0	116	269	269	561
426	161	204	421	314	314	334
427	0	1,025	0	0	0	233
428	14	2,509	526	0	0	509
429	0	8,486	300	0	0	256
430	2,130	6,790	641	304	304	2,450
432	192	18	332	83	83	449
433	223	35	409	131	131	262
434	78	204	20	91	91	186
435	20	493	31	143	143	624
436	171	138	196	0	0	365
440	60	0	105	74	74	294
483	6,616	628	1,864	2,973	1,215	1,316
484	5	3,873	252	0	0	608
493	107	11	457	861	861	545
498	238	5	413	340	340	734
510	156	2,905	58	69	69	454
511	0	262	0	0	0	229
512	144	31	623	81	81	893
	10,494	**27,617**	**6,764**	**5,733**	**3,975**	**11,303**
ROUND 5D						

*Note: Negative numbers correspond to a projected loss of population by TAZ.

**Note: 1758 of the capacity in TAZ 483 have been built since 2000 (the date of the parcel database), reducing the total capacity to 3975.

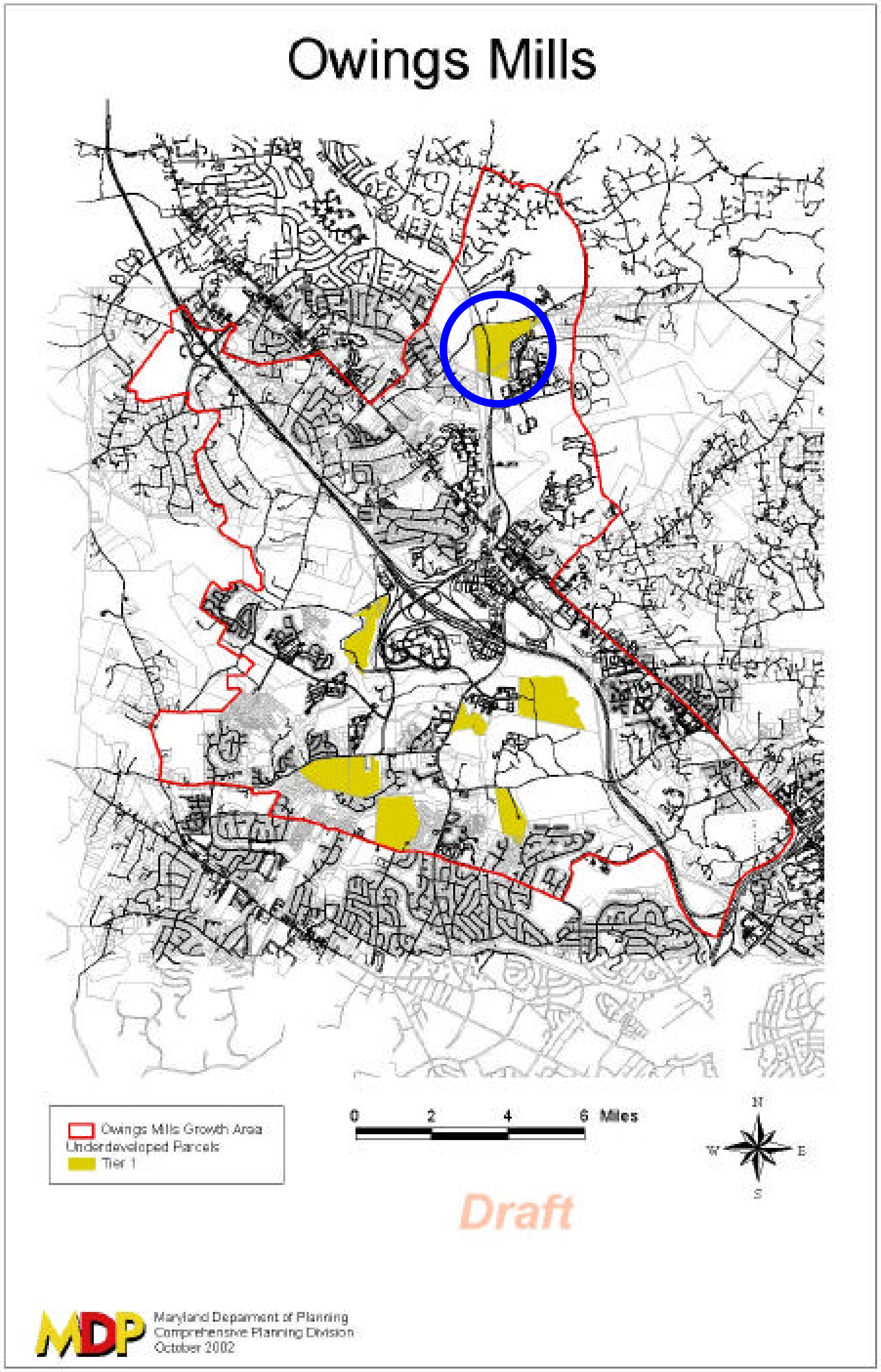


Capacity : Tier 1

- Large Developable / Greenfield Parcels
- Key Parcels That Were Discussed At The Last Meeting
- Parcel Adjacent to T. Rowe Price

Identified by group. 35 acre parcel on Lakeside and Painter’s M ill. Zoned Commercial. Between T. Rowe Price and OM Corporate Campus. County shows as vacant with potential. Owner listed as McDonough School.

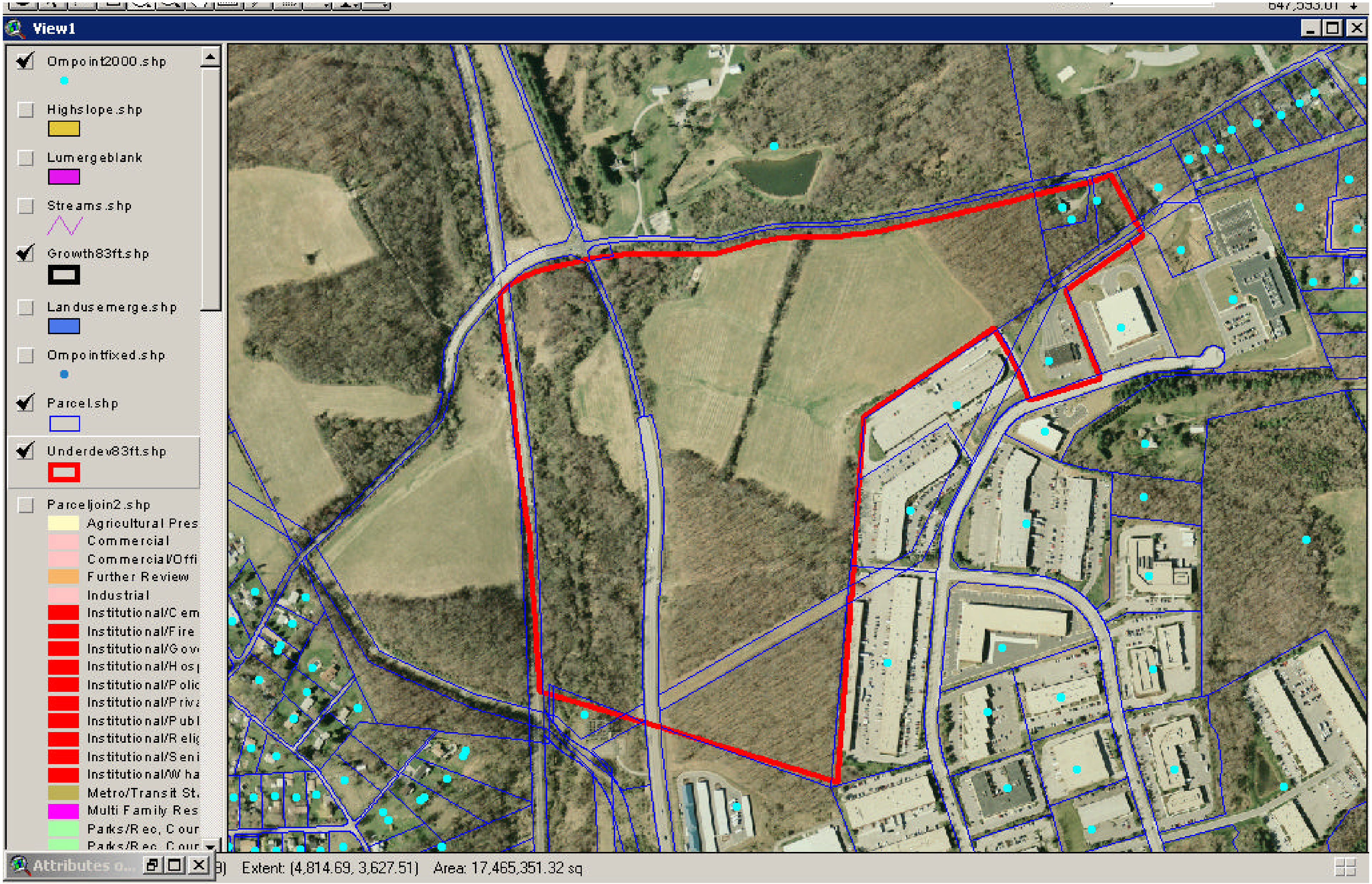
Parcel Adjacent to T. Rowe Price



Gywnnbrook Ave. and Owings Mills Blvd.

- Tier 1 Capacity
- Zoned Industrial
- Potential Site For School
- New Development Occurring On Adjacent Parcel To The West

Identified by Group. Potential school site. Zoned industrial. Owings Mills Boulevard. 91 acres.

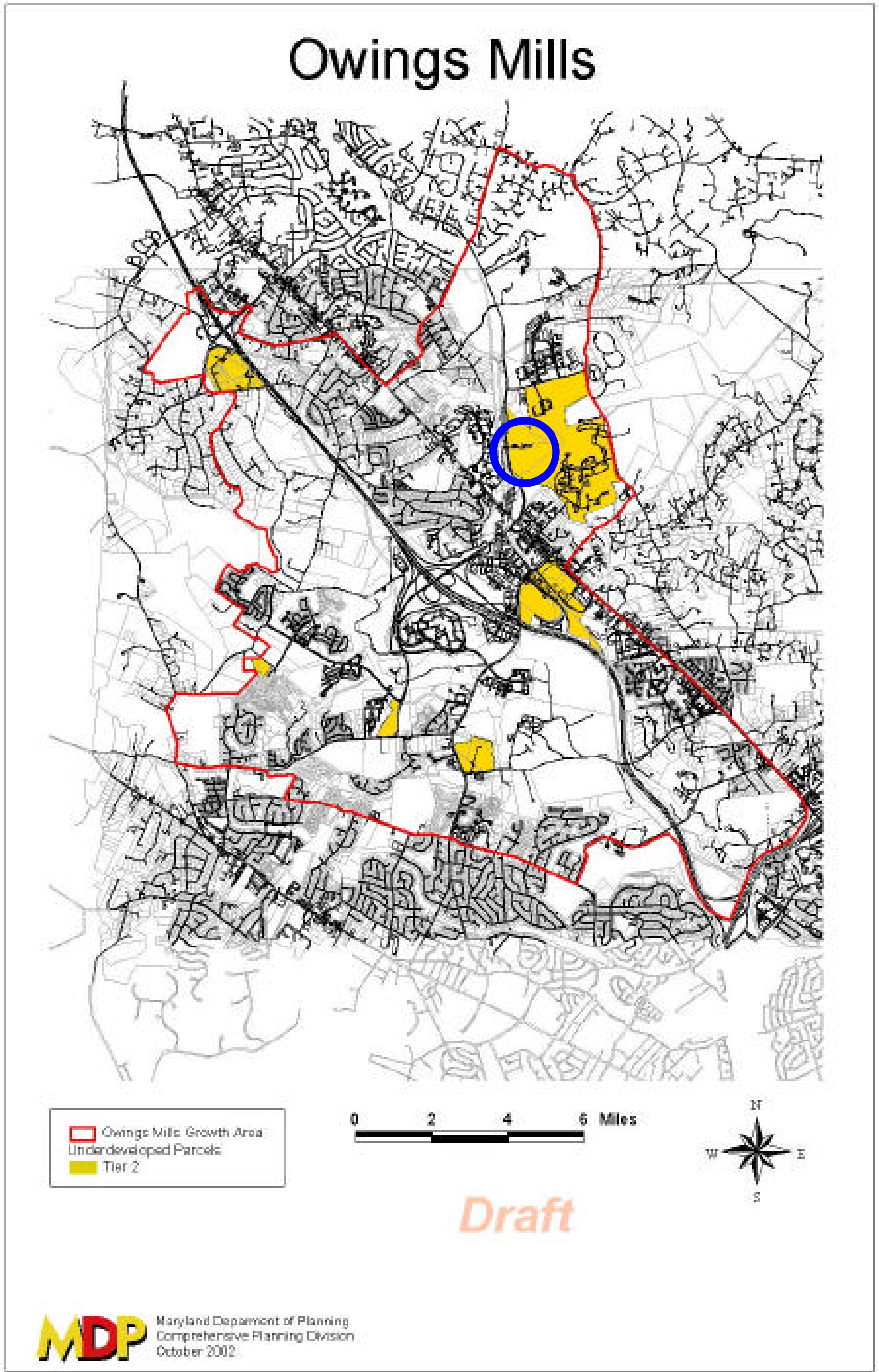


Intersection of Gywnnbrook Ave. and Owings Mills Blvd.

New Development Adjacent to The Parcel

Tier 1 Summary

Tier 1 Parcels				
Name	**Acres**	**General Zoning**	**Land Use**	**Residential Capacity**
Ballard Property	47	Residential	Underdeveloped	135
Lee Property	86	Residential	Underdeveloped	259
Robinson	39	Residential	Underdeveloped (Single House)	116
McDonough Crossroads	101	Commercial	Underdeveloped	
Gwynbrook Avenue Parcel		Industrial	Underdeveloped	
Owings Mills Corporate Campus	34	Commercial	Underdeveloped	
Esplanade	54	Commercial	Underdeveloped	
			Total NHC for Tier 1	**510**

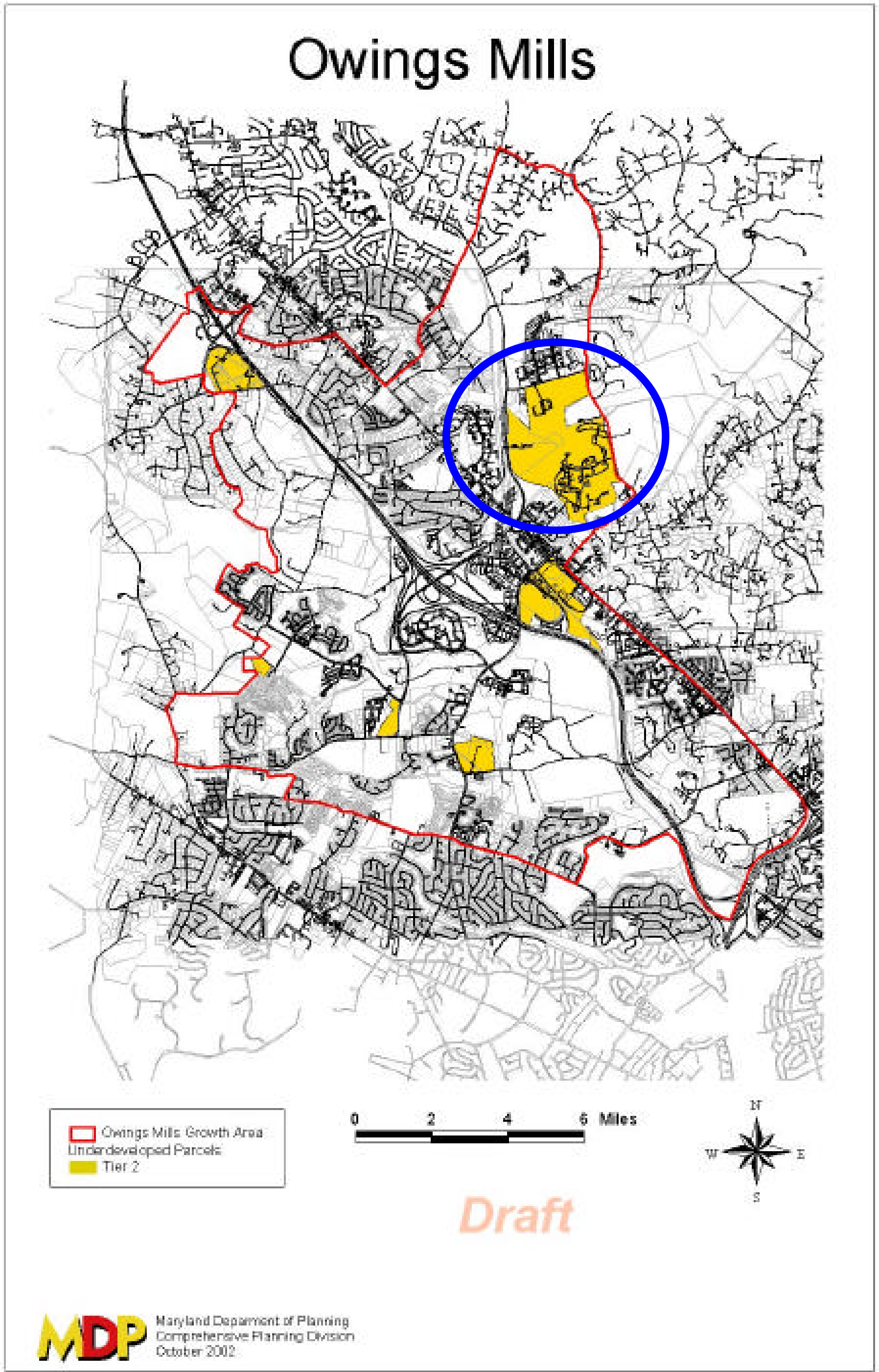


Capacity: Tier 2

- Medium Developable Parcels / Underdeveloped Parcels
- Large Acres of Land Already Subdivided
- Circled is The Colts Complex

Identified by Group. Colts Complex. 36 Acres Zoned Industria l. Potential for Redevelopment.

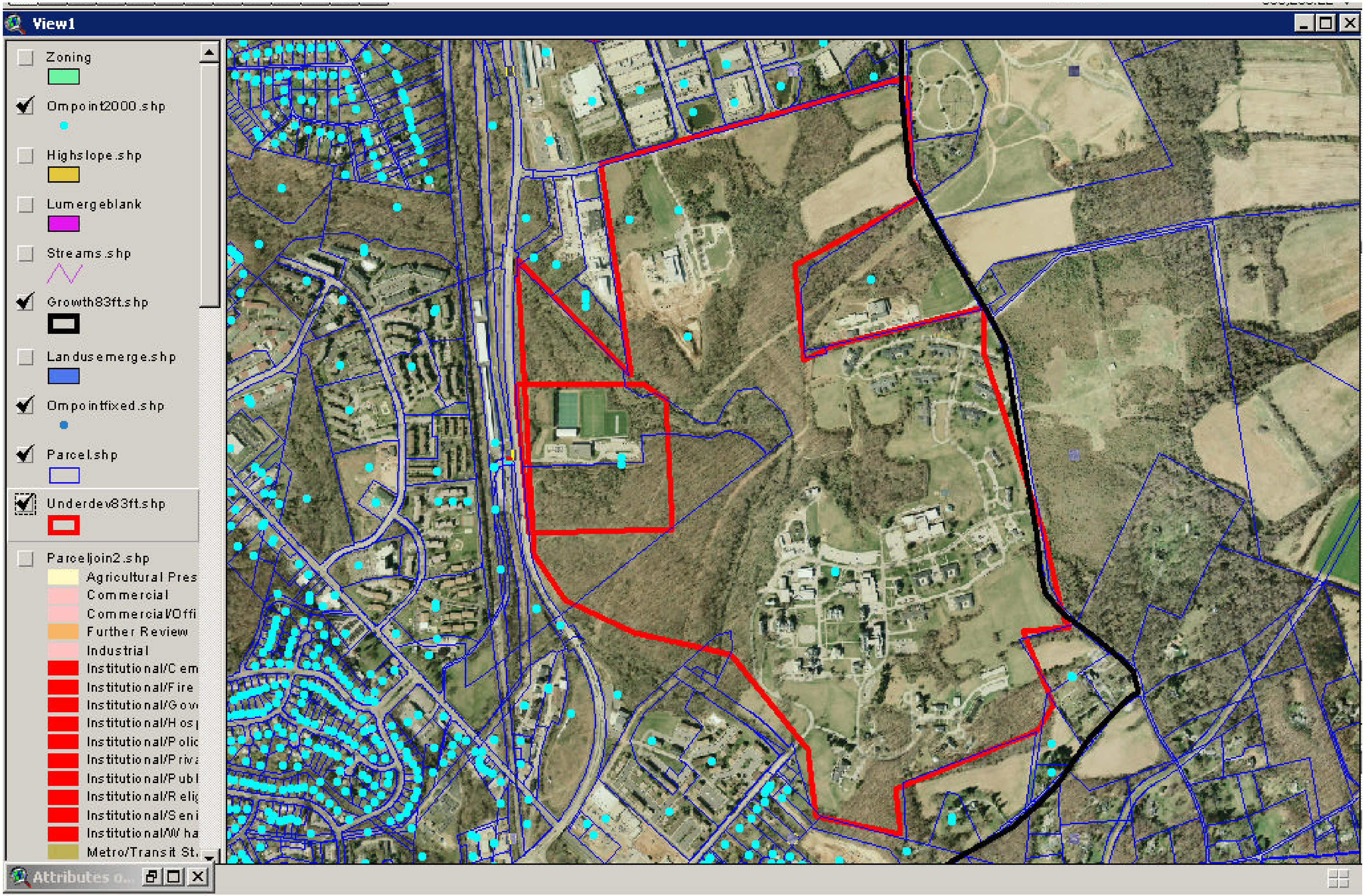

Boulevard
Pad Site 2
Sale or Lease



Capacity: Tier 2

- Rosewood Campus
- Potential Redevelopment

Identified by Group. Rosewood Campus. 400 acres zoned Industrial. Potential for redevelopment.

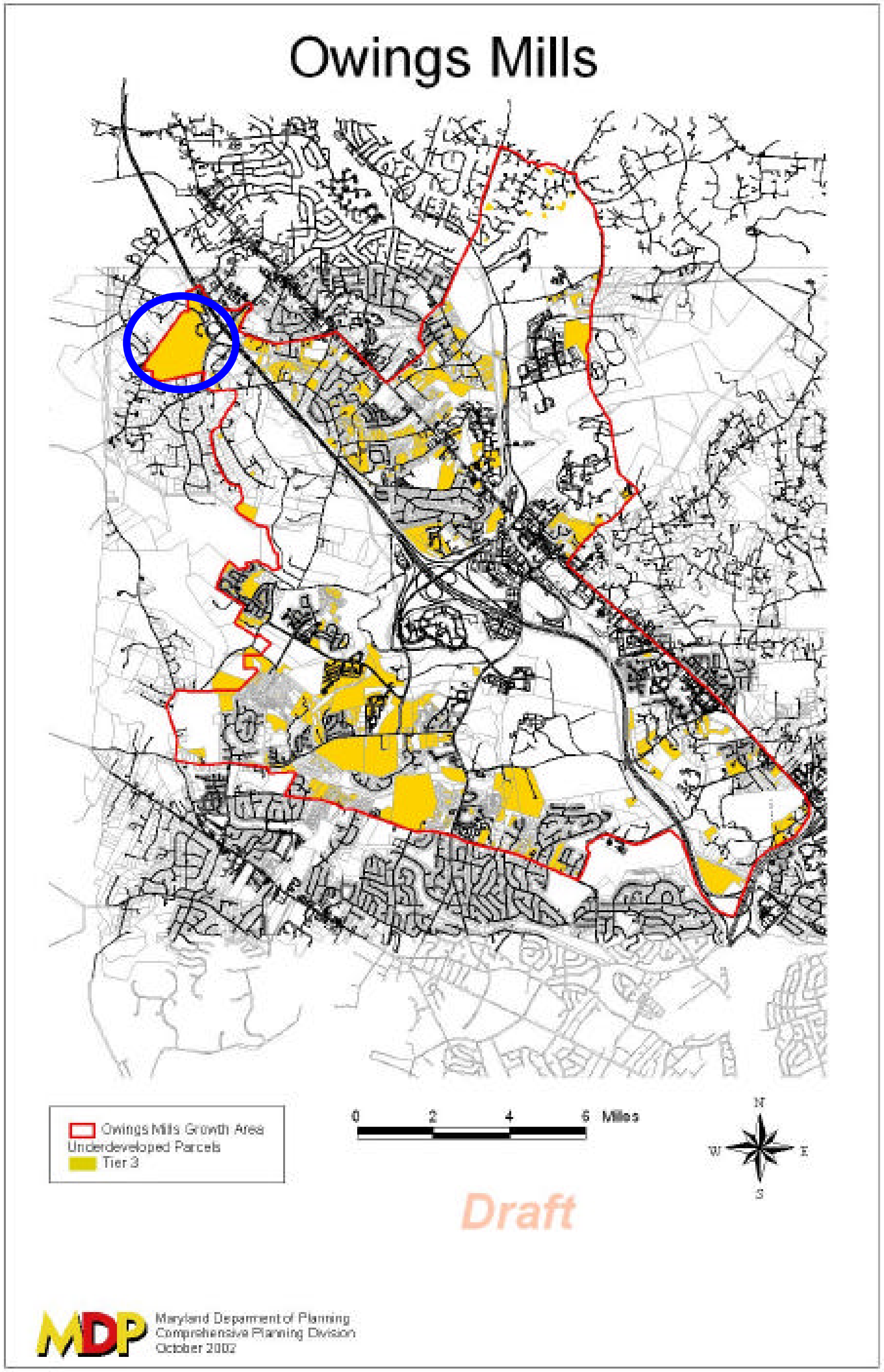


Rosewood Campus

Rosewood Campus

Tier 2 Summary

Tier 2 Parcels				
Name	**Acreage**	**General Zoning**	**Land Use**	**Residential Capacity**
McDonough School	46	Commercial	Underdeveloped	
Painter's Mill (across from Metro)	91	Industrial/Commercial	Underdeveloped	
Church Road Area	65	Commercial	Underdeveloped	
Corner of Lakeside/OM/Lyon's Mill	50	Residential	Underdeveloped	252
Rosewood Campus	378	Industrial	Potential Redevelopment	
			Total NHC for Tier 2	**252**

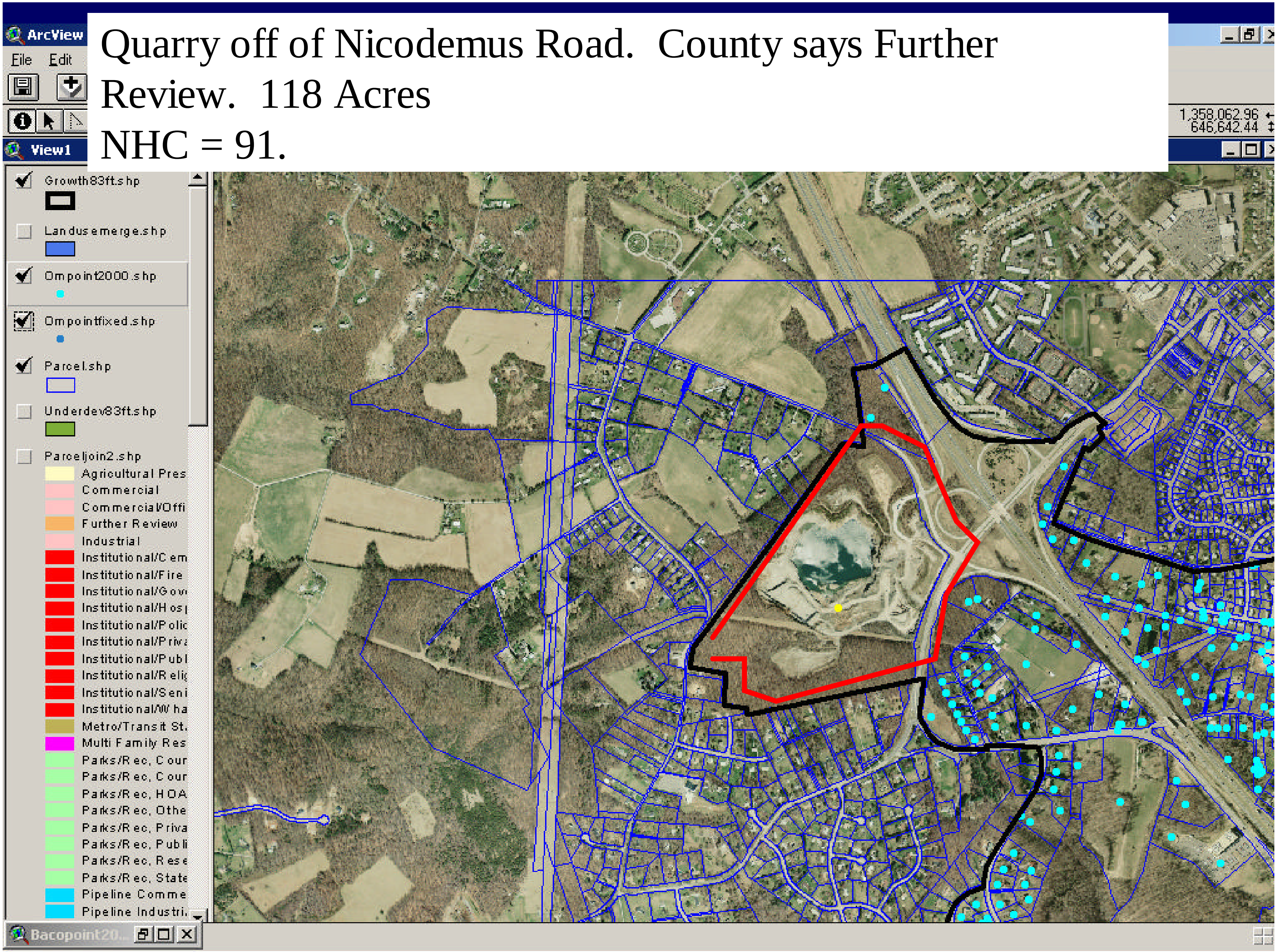


Capacity : Tier 3

- All Parcels with New Household Capacity

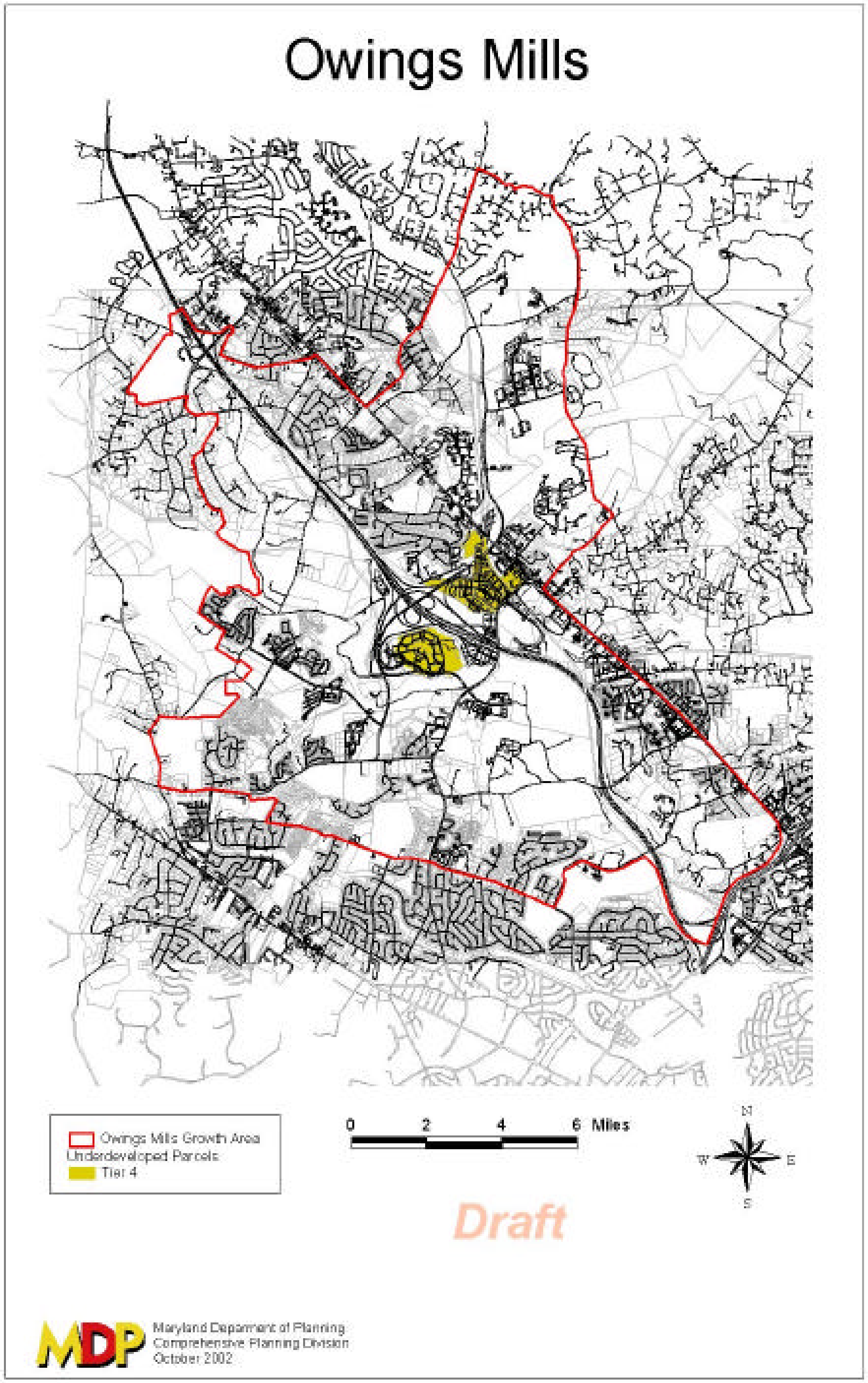
Quarry off of Nicodemus Road. County says Further Review. 118 Acres

NHC = 91.



Tier 3 Summary

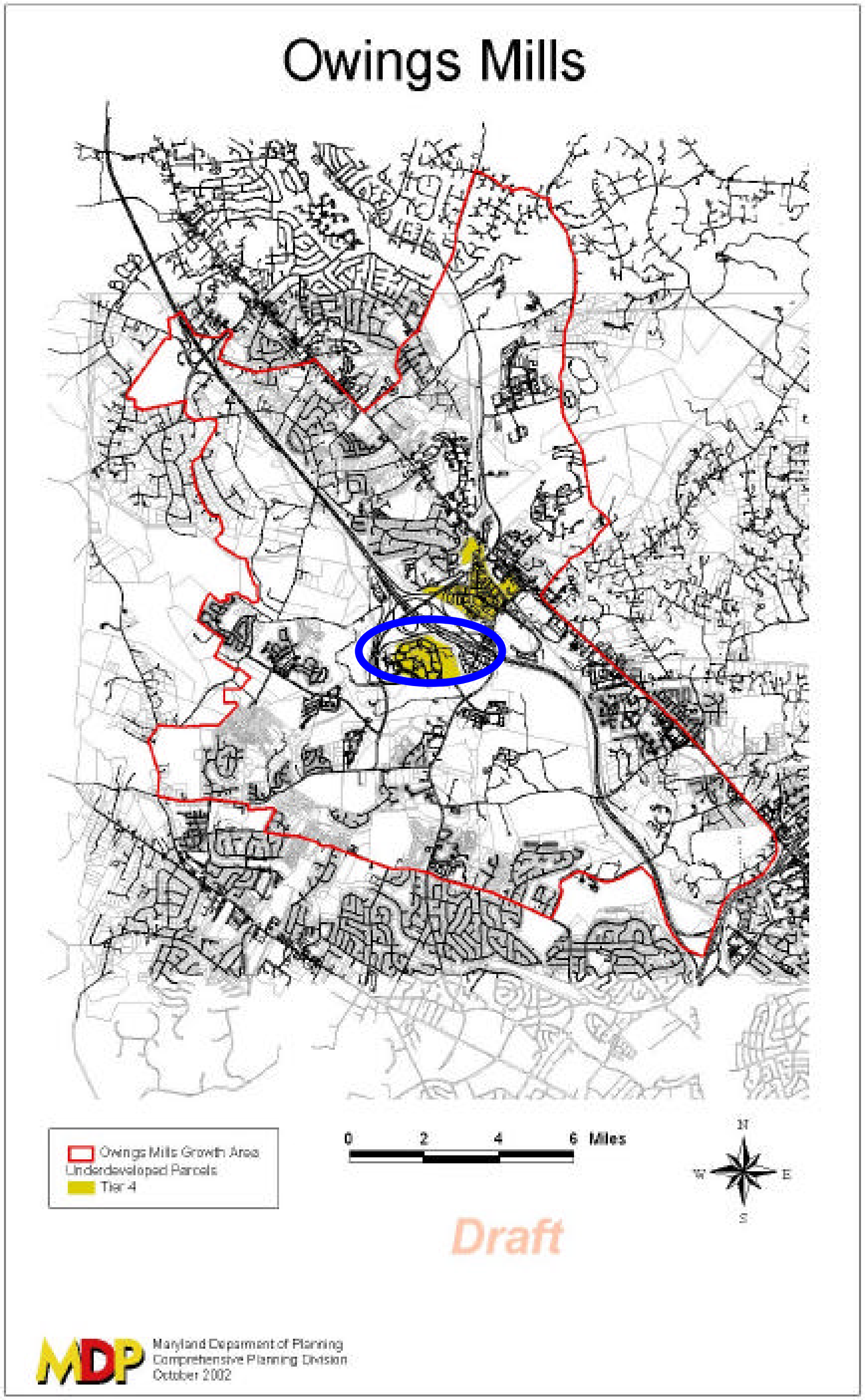
Tier 3 Parcels - Parcels with Residential Capacity				
Number of Parcels	**Acreage**	**Capacity**		
853	1,470	3,213		
			Total NHC for Tier 3	3213



Capacity : Tier 4

- Older Commercial and Industrial Areas with Redevelopment Potential
- Example in Baltimore County – Golden Ring Mall Area


Satisfaction Guaranteed



Capacity : Tier 4

- Older Commercial and Industrial Areas with Redevelopment Potential
- Owings Mills Mall and Metro Station


macy's

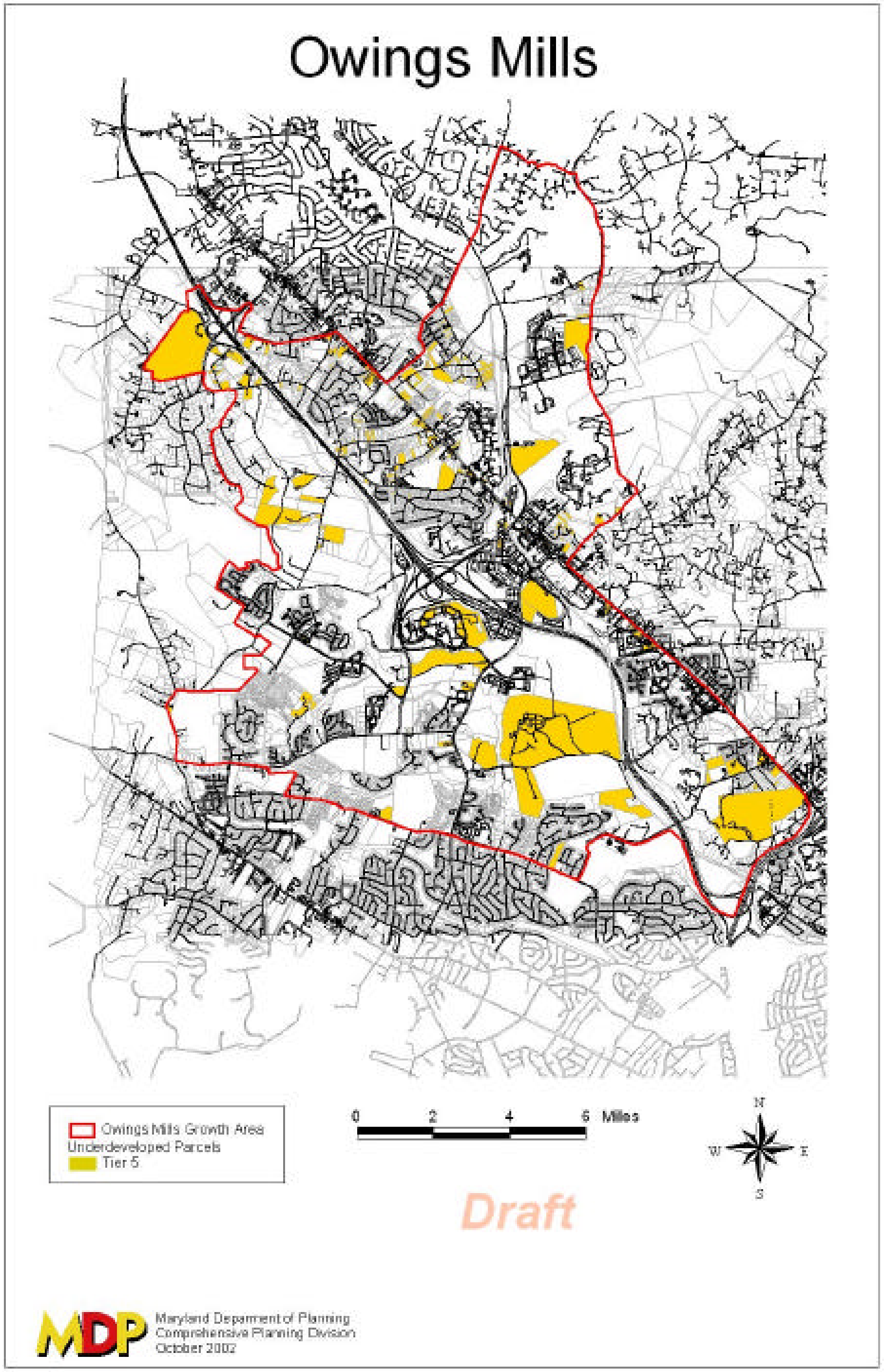
No Access to Owings Mills Mall from the Metro Station.


NO TRESPASSING

B

Tier 4 Summary

Tier 4 Parcels - Potential For Redevelopment			
Name	**Acreage**	**General Zoning**	**Land Use**
Owings Mills Mall	100	Commercial	Commercial
Dolfield Road Area (near metro)	32	Commercial/Industrial	Commercial/Industrial
Reisterstown Road Corridor	1,400	Industrial	Industrial

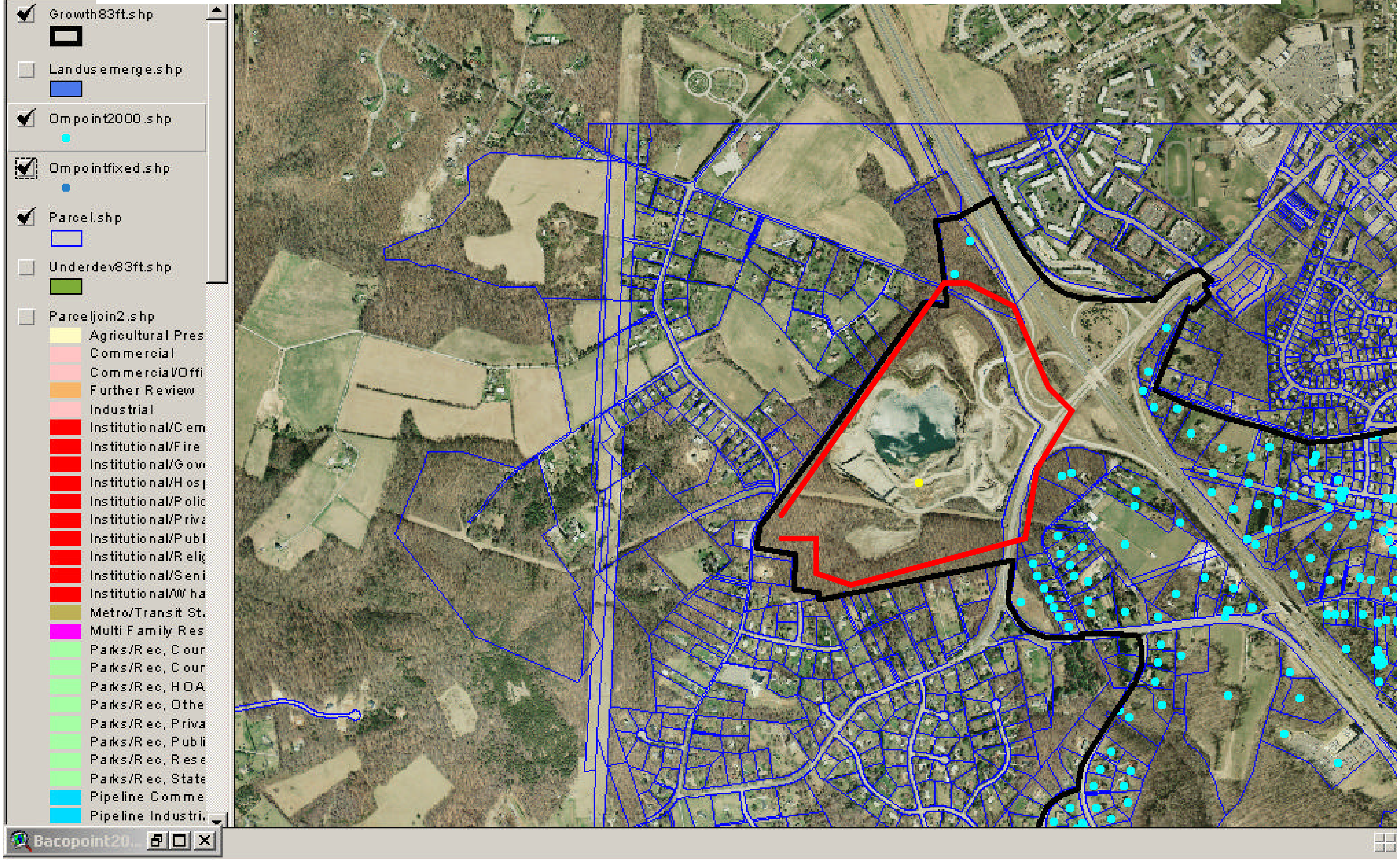


Capacity : Tier 5

- Alternate Approach
- Land Value is Greater than Improvement Value

Quarry off of Nicodemus Road. County says Further Review. 118 Acres

NHC = 91.



Tier 5 Summary

Generalized Zoning	Number of Parcels	Acreage	NHC
Commercial	66	154	0
Industrial	17	226	0
Low Density Residential	19	344	131
Medium Density Residential	115	176	284
High Density Residential	4	10	1
Least Protective	6	44	0
Totals	**227**	**954**	416

APPENDIX B

Development Statistics

Prototype Development Characteristics & Guidelines for TOD Development

	Devt Type	Acreage	Total s.f.	Land Use Mix	FAR	Retail S.F.	Office S.F.	Hotel Rooms	Employees	Conversion Factor	Residential Density (buildout)	Res Units (build-out)	Breakdown of units (if known)	Mix of Uses (employees /houses)	Parking	Notes
Courthouse - Justin Clark - figures based on buildout	TOD	240	10,454,400	9,004,000 (61.5%) res; 684,750 (4.6%) hotel; 1.35% retail; 32.4% office; 14,630,342 total s.f.	4.80	197,664	4,743,928	913	20292	Office: 1 job/250 s.f.; Retail: 1 job/400 s.f.: Hotel .9 job/room	38	9,004	5215 mf; 242 attached; 914 Detached	2.2536175	15,683	Hotel:750s.f./room. Res: 1000 s.f./unit avg. Capacity housing density=buildout and it is close to net density. FAR includes residential. Detached units=total units at buildout - (mf+attached+development remaining)
Ballston - Justin Clark - figures based on buildout	TOD	332.8	14,496,768	681,750 (3%) hotel; 10,687,000 (51%) res; 40% office; 5.4% retail; 20,978,384 s.f. total.	6.00	1,153,156	8,456,478	909	37527	Office: 1 job/250 s.f.; Retail: 1 job/400 s.f.: Hotel .9 job/room	32	10,687	5553 mf; 784 attached; 932 Detached	3.5114534	22,798	Hotel:750s.f./room. Res: 1000 s.f./unit avg. Capacity housing density=buildout and it is close to net density. FAR includes residential. Detached units=total units at buildout - (mf+attached+development remaining)
Bethesda Row - Alex Inglese - figures based on buildout	Urban Redevt - Model for Reisterstown Road	12	522,720	714,400 total s.f.; 29.3% res; 45.3% retail; 25.2% office	1.37	323,700	180,700		1532.05	Office: 1 job/250 s.f.; Retail: 1 job/400 s.f.	210,000 s.f.	180	180 mf	8.5113889	927 + 279 - Mont Co Garages 57 and 31	Retail includes restaurants, movies. To make economics work for residential, allow extra height. Alex Inglese re: FAR: 1.5 FAR overall. 1 FAR retail + 1.5 FAR residential for Phase 7.

King Farm - Jim Wasilak (Rockville)/ Rob Goodall (Torti Gallas CHK)	Greenfield TOD	440	19,166,400	Office: 38.4%; Retail: 1.5%; Residential: 60% (4,838,100 s.f.)	Office: .75 max, .74 approved (.16 right now); Retail : .66	122,800	3,100,000		12707	Office: 1 job/250 s.f.; Retail: 1 job/400 s.f.	9.52 gross (includes 200 apartments in town center)	3200	392 (12%) sf; 943 (29%) th; 665 (21%) condo; 1200 (38%) apts, including 47 on top of retail	3.9709375		Retail FAR refers to 2-block area that includes parking, Safeway, retail, upper story residential. Mix of uses: residential floor area based on avg s.f. per single family home, townhouse, condo, and apt, multiplied by the number of each type.
Clarksburg Town Center District	Greenfield TOD	635	27,660,600			300,000	470,000		2630	Office: 1 job/250 s.f.; Retail: 1 job/400 s.f.		2600	25-45% mf; 30-50% attached; 10-20% detached	1.0115385		
Clarksburg Tansit Corridor District	model for Reisterstown Road?	990	43,124,400			150,000	4,850,000		19775	Office: 1 job/250 s.f.; Retail: 1 job/400 s.f.		2790	Transitway: 30-50% mf; 40-60% attached; 50-60% detached. MD 355: 5-10% mf; 30-40% attached; 50-60% detached.	7.0878136		
Columbia Pike, Town Center	Reisterstown Rd				2 or 3, depends on process											
Columbia Pike, Village Center	Reisterstown Rd				2 or 2.5, depends on process											
Columbia Pike, Neighborhood Center	Reisterstown Rd				2											
Columbia Pike, Gateway	Reisterstown Rd				2 or 2.5, depends on process											
Reston Town Center Core Area	Greenfield Town Center	84.25	3,669,930		0.95	524,148	2,196,091	987	10,983	Office: 1 job/250 s.f.; Retail: 1 job/400 s.f.	50 (based on "high density" in zoning code)	600		18.304709		commercial s.f. from Floor Area Tracking sheet.

Notes:
Conversion Factor for Retail and Office from Baltimore Metropolitan Council, used for Cooperative Forecasting. (Source: Transportation Choices, Vibrant Places, Baltimore

Conversion factor for hotel from Institute of Transportation Engineers, Trip Generation, 6th Edition, p.502
Bethesda Row Retail s.f. includes 60,000 s.f. restaurant
King Farm Contact: Jim Wasilak, City of Rockville Planning Department
Parsons Brinckerhoff Mix of Uses based on Puget Sound Regional Council, Creating Transit Station Communities in the Central Puget Sound Region - A Transit-Oriented Development
Peter Calthorpe recommendations from The Next American Metropolis
Easa & Samdahl: Said Easa and Donald Samdahl, Transportation, Land Use, and Air Quality: Making the Connection, 1998, p. 310
Atlantic Steel commercial and residential density from p. 26., Jacoby Development Company, Application for Designation Under Project XL,

APPENDIX C

MDP’s Growth Simulation Model

MDP's Growth Simulation Model

MDP uses several analysis tools to simulate the effects of future development under different management scenarios. The Growth Simulation Model (GSM) focuses on future landscape changes and development patterns. Results from this work helps to show the utility of different planning tools.

Growth Management Simulation Model

The following paragraphs outline MDP's growth model in general. This model is usually customized with local data and knowledge. **Figure 5.1** is a schematic of this model.

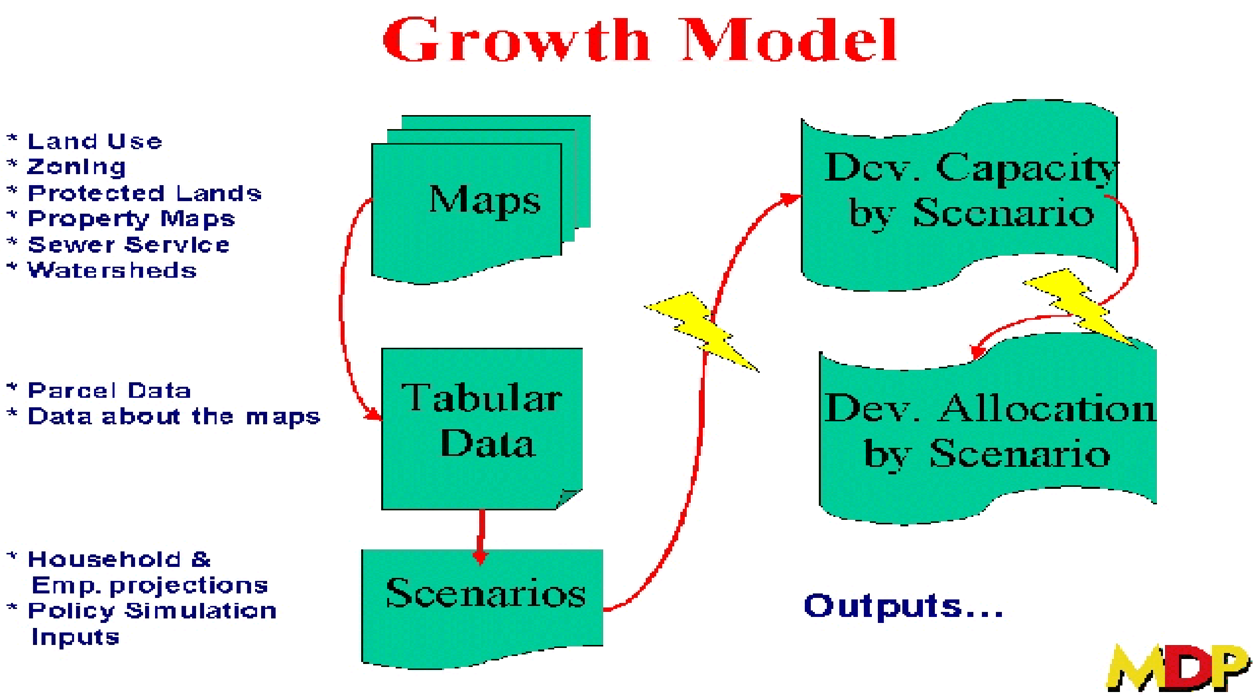


Figure 5.1

The growth model projects the existing landscape into a series of possible "future landscapes", each a function of different land use management scenarios. Land use change is estimated using population, household, and employment projections along with other inputs that are part of the growth scenarios. New development is calculated as a function of household demand, existing or hypothetical management choices (e.g., clustering, transfer of development rights, growth areas, and agricultural land preservation), and other factors that simulate local concerns and policies that may influence the type and locations of future development.
The model uses data from geographic information system (GIS) overlays. The GIS database includes information on land use, streams, watershed and county boundaries, zoning, sewer service, and protected lands (e.g., agricultural easements, parks, etc.). This database also includes Department of Assessments and Taxation parcel information in the

form of point data.

All of this information is combined into a master parcel database. Once complete, this database includes the following data for every piece of land (i.e., parcel) in the study area.

1. zoning
2. acreage
3. sewer service category
4. land use
5. 12 digit subwatershed
6. topology
7. number and date of improvement(s) (i.e., major structures)
8. value of parcel and improvement(s)
9. address and owner
10. capacity for development
11. new land use per each scenario

Small-Area forecasts are used for population, household, and employment projections for counties with Transportation Analysis Zones (TAZs). For non-TAZ counties, recent (10 years) growth patterns using parcel data were analyzed for trends. Future growth was assumed to follow a similar pattern (with in constraints) unless otherwise altered by a scenario.

In this project, 2000 is the base year and the year 2025 is the planning horizon. Household and employment projections for each watershed are allocated to categories of developable land (parcels) within each subwatershed. Allocations of household and employment demand are based on the projections and relative capacity of developable land in each category of developable land, unless otherwise altered by a scenario. In addition, parcels “attractiveness factors” are also used in the allocation process. The capacity of each parcel of developable land in each watershed is based on its size (number of acres), current land use/cover type, zoning, and sewer service category. The types of land use controls simulated were unique to each scenario.

Current Trends Scenario

Development Capacity - Land supply (i.e., capacity) is calculated by linking the allowable zoning density of a parcel to its size and improvements and other characteristics of the parcel. In the areas zoned for development, the “yield” of a zoning district was assumed to be 75% of its allowable density. This assumption is based on the fact that development frequently occurs at densities lower than what is permitted. Based on research as well as conversations with local governments, this assumption can be altered to reflect unique situations in each jurisdiction. In rural zoning districts, MDP is more certain about the “yield” of the zones. In addition, development capacity for each parcel is not a straight division of the parcel’s acreage by the permitted or yielded density of its zoning, plus any reductions due to existing development that may be on the parcel. In attempt to be realistic in estimating infill capacity, the model basically does the calculation mentioned above and then reduces that number by half. For example: if a ten acre parcel is zoned for one dwelling unit per acre and it has one house on it, a simple capacity analysis would give a capacity for nine new houses. In this situation, the model would give a potential capacity of four new houses on this parcel.

In addition to the capacity methodology outlined above, some types of parcels are automatically given no development capacity. These include: wetlands, exempt properties (e.g., institutional and non-profit properties), cemeteries, parks, easements, and other protected lands. As with most of the model, this component can be customized with input from local planners and others.

Development Allocation - Projected development (i.e., number of new households or employment) is allocated to developable land (i.e., land with capacity) in each watershed. This leads to an estimate of the amount of land converted to different land use types for each scenario. There are many factors that affect the simulation of allocating projected growth. Household and employment projections (using small area forecasts where available) establish how much development needs to be allocated by watershed, the capacity step outlined above establishes where new development can go, and the make-up of the scenarios and locational decision rules guide where the projected growth is actually allocated.

This is done on a parcel - by - parcel basis. For example: a dispersed growth scenario may guide growth to low density zones on large lots; and a Smart Growth scenario may direct projected growth to occur on smaller lots, on central sewer, in the Priority Funding Area.

Non-Residential Growth – While residential growth almost always dominates the growth numbers for an area, the model does project non-residential land use change. The following generally outlines how this is done.

- *Baseline ratio* - the model establishes a baseline ratio of existing employees to acres of non-residential (e.g., industrial, commercial, etc.) land by sector. This results in ratios of employees by sector / acre / type of non-residential land.
- *Projections* - Employment projections are integrated into the model.
- *Projected Non-residential land use change* - Using the ratio established earlier, the employment projections are matched to the corresponding categories of non-residential land. These projections are added to the base year employment figures. Estimates of increased non-residential are made by keeping the ratio between employees and land equal to the baseline ratio.
- *Hypothetical example* - In 2000 there were 1,000 acres of manufacturing land uses and 5,000 employees in this sector. The baseline ratio is 5:1 manufacturing employees to acre of manufacturing land. If the Year 2020 projection was 2,500 projected employees in this sector, then the manufacturing land demand would be an additional 500 acres for the year 2020.

APPENDIX D

Community Viz 3-D Visualization

COMMUNITY VIZ

The Maryland Department of Planning decided to make use of a software package known as Community Viz (CV). This was not a part of the original grant, but it was the perfect opportunity to make use of the abundance of Owings Mills' data that was at MDP's disposal.

Community Viz is a series of GIS-based decision support tools that help Planners and GIS Professionals visualize complex analyses and land-use planning concepts. The program is a software extension to ArcView. Developed by the Orton Family Foundation, CV puts technology in the hands of planners, elected officials, and concerned citizens. While it is very data and resource intensive on the back end, it does an excellent job with visualizations. There are three main components of the Community Viz software: Sitebuilder 3D, Scenario Constructor, and Policy Simulator. For the Owings Mills TOD project, Sitebuilder 3D and Scenario Constructor were the two components used in the study.

First, the Sitebuilder 3D module was used to simulate 3D scenes of a small sub-area of the Owings Mills Growth Area. The immediate area surrounding the Owings Mills Metro Stop, the heart of the Transit Oriented Development in the two alternative growth scenarios, was the section that would be the most important area to study in detail. In cooperation with The Baltimore County Planning Department, we collected imagery and Planimetric-Topographic data for the site, which became the base for the 3D visualization. Once the base terrain was compiled, we began the effort of simulating, in 3D, the current landscape in the Owings Mills TOD area immediately surrounding the transit station. Figure 6.1 shows a screen capture of this visualization.

Figure 6.1 CV's Sitebuilder 3D is used to create Owings Mills existing landscape.

From these three-dimensional landscapes, a video fly-through was created. Attached in this grant is a CD which will include numerous fly-throughs in and around the Owings Mills Metro / Mall area. A Read Me File will give the viewer information on each video fly-through.

This Sitebuilder 3D tool was used extensively in the project to illustrate to county planning staff, project partners, and others, what exists in the study area and what could potentially exist if alternative development patterns were considered in the study area.

The next module of Community Viz that was used in this analysis was the Scenario Constructor module. In order to complete the Smart Growth Index model run for the TOD scenario, the general household and employment numbers must be laid out on the landscape to create a parcel-polygon site plan that incorporates the dwelling units and jobs that are associated with the scenario. Scenario Constructor allowed us to plug in information about density, mix of uses as well as site-level constraints to allow us to update the parcel-polygon layer on the fly. An example of an "Indicator" is shown in Figure 6.2.

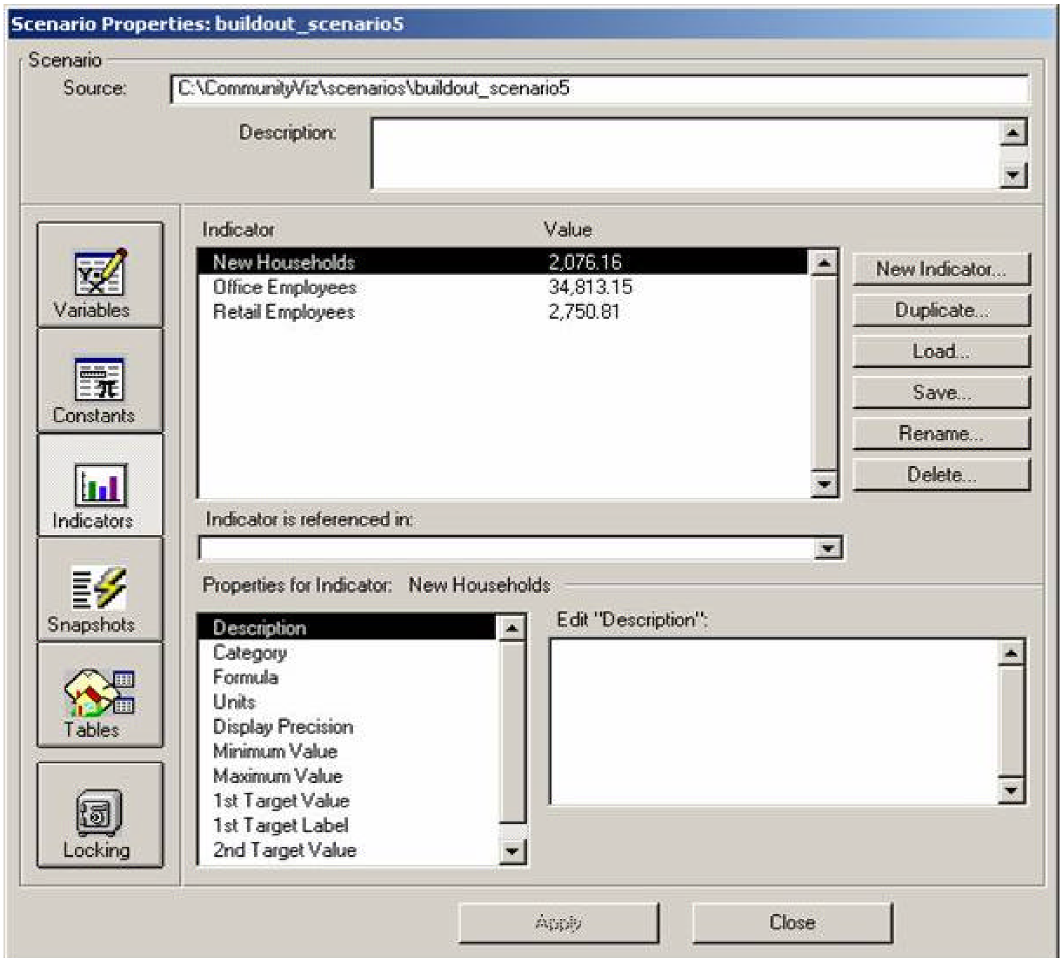


Figure 6.2   The image is the scenario properties dialogue box within CV's Scenario Constructor. Indicators such as New Households and Employees can be manipulated for individual scenarios.

After the Scenario properties were manipulated to fit our specific scenario needs, CV will calculate the build out on the area, and produce and output similar to Figure 6.3.

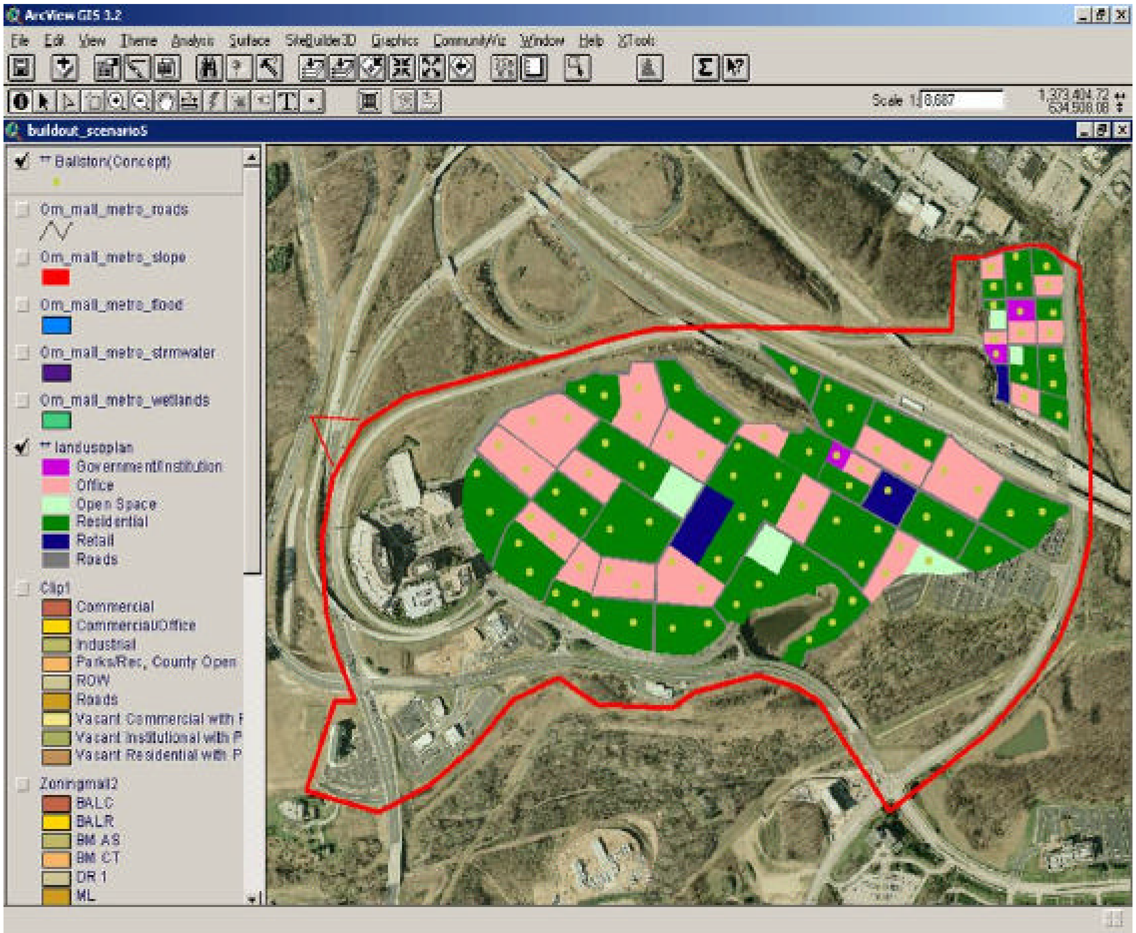


Figure 6.3 This figure represents a Build Out Scenario for the Owings Mills TOD Scenario. The "dots" represent commercial, residential, and institutional build out.

The Maryland Department of Planning's work with the Community Viz software has proven to be very beneficial in conveying messages of "What is" and "What could be" to Baltimore County Planning officials. Our department is still working with Community Viz to improve upon our 3D rendering of the scenario outputs.

APPENDIX E

Center for Clean Air Policy’s Emission Analysis

Quantification of Greenhouse Gas Emissions Reductions from TOD: Owings Mills

International Climate Policy

International policy response to the threat of climate change was initiated in 1992, with the development of the United Nations Framework Convention on Climate Change (UNFCCC). In 1997, at the COP-3 in Japan, the Kyoto Protocol was adopted, committing participating countries to a reduction in their greenhouse gas (GHG) emissions. While the United States has not ratified the Kyoto Protocol, state and regional efforts are building a patchwork of policies designed to reduce GHG emissions.[1]

The Significance of Transportation Sector GHG Emissions

In 2000, fossil fuel combustion was the most important source of global emissions accounting for 80 percent of GHG emissions, and the transportation sector is not only one of the main contributors to global CO_2 emissions, it is also the fastest growing.[2] In the United States, vehicle miles travel (VMT) increased 22 percent between 1990 and 2000 and is expected to increase by 75 percent from 2000 to 2025 due in large part to sprawling development. *Measures that reduce VMT also reduce GHG emissions, improve air quality, and can create more equitable travel choices for individuals and society as a whole.* Adopting land use measures that focus on tempering suburban sprawl and guiding development into more efficient locations can slow VMT growth, especially when bolstered by complementary efforts to promote alternative travel choices. Figure 1 provides an overview of VMT and criteria pollutant reductions from transit-oriented development (TOD) efforts such as Owings Mills. Figure 2 highlights the link between VMT and GHG emissions.

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[1] The New England Governors and Eastern Canadian Premiers (NEG/ECP) have established a Climate Change Action Plan calling for New England states and Eastern Canadian provinces to work together to reduce GHG emissions, with a near-term goal of achieving 1990 GHG levels by 2010. Approximately 130 cities participate in the Cities for Climate Protection Campaign sponsored by the International Council for Local Environmental Initiatives (ICLEI) and some 25 states (including New York, New Jersey, Massachusetts and Connecticut) have climate action plans aimed at reducing GHG emissions.

[2] U.S. EPA. *Inventory of US Greenhouse Gas Emissions and Sinks: 1990 200.* Washington, DC: US EPA 2002.

Figure 1: Infill vs. 'Greenfield' Developments*			
Location	Description of TOD / infill site	VMT Reduction	Emissions Reduction
Atlanta, GA	138-acre brownfield, mixed-use development project	14 - 52%	37 - 81% NOx 293 - 316% VOC
Baltimore, MD	400 households and 800 jobs on waterfront infill development	55%	36% VOCs 40% NOx
Dallas, TX	400 housing units and 1500 jobs located 0.1 miles from the Dallas Area Rapid Transit (DART)	38%	43% VOC 48% NOx
Montgomery County, MD	Infill site near major transit center	42%	31% NOx
San Diego, CA	Infill development project	52%	42% NOx
West Palm Beach, FL	Auto-dependent infill project	39%	28% NOx

Data from: EPA. *Comparing Methodologies to Assess Transit and Air Quality Impacts of Transit Oriented Development, Review of Literature and Case Studies.* October 2000.

Figure 2: The VMT - GHG Connection
1 VMT ? 1 lb CO_2

There are about 19.6 lbs CO_2 per gallon of gasoline* and the average passenger vehicle has a fuel economy of 20.1 miles per gallon.** 19.6 divided by 20.1 equals 0.98 lbs CO_2 per mile, which we are approximating as 1 lb CO_2 per mile. The GHG emission rate is lower for more efficient vehicles (e.g., hybrid-electric) and higher for less efficient vehicles (e.g., SUVs). Unlike conventional air pollutants, CO_2 emissions (which remain in the atmosphere for 100 years) are not time-of-day or weather-dependent. Thus any opportunity to reduce VMT will reduce CO_2 emissions and help mitigate global climate change. CO_2 emissions also vary with vehicle speed, but we have not included those effects here.[3]

* U.S. Department of Energy, *Form EIA-1605*. http://www.eia.doe.gov/oiaf/1605/forms.html
** Oak Ridge National Laboratory, *Transportation Energy Data Book*, Edition 22, Tables 7.1 and 7.2.

The Kyoto Protocol & Emissions Trading

The Kyoto Protocol sets specific GHG reduction targets for 2008-2012 (the first commitment period), based upon a percentage of a country's 1990 GHG emissions. The countries covered under this cap (developed nations or Annex I Parties) are allowed, under the treaty framework, to trade emissions credits as part of a set of so-called flexible mechanisms. The two primary flexible mechanisms include the Clean Development Mechanism (CDM) and Joint Implementation (JI). The difference in design between these two instruments stems from the fact that JI projects take place within developed countries, who all have a target, whereas CDM projects take place in developed countries, who have no limit on their greenhouse gas emissions

[3] CCAP is preparing a paper with Dr. Larry Frank on urban form and CO_2 emissions, which includes analysis of CO_2 vs. speed based on EPA vehicle test data.

The Kyoto Protocol also allows Annex I Parties to group together to form an emissions 'bubble' representing a common target for those in the bubble.[4]

Specifically, IPCC rules, through the Kyoto Protocol, define how emissions trading works:

> Through emissions trading, Annex I Parties may acquire assigned amount units (AAUs) from other Annex I Parties that find it easier, relatively speaking, to meet their emissions targets. This enables Parties to utilize lower cost opportunities to reduce emissions, irrespective of the Party in which Party those opportunities exist, in order to lower the overall cost of reducing emissions. Similarly, Annex I Parties may also acquire ERUs (from joint implementation projects), CERs (from CDM projects) or RMUs (from sink activities) from other Annex I Parties. Transfers and acquisitions of these units are to be tracked and recorded through national registries (see below).
>
> In order to address the concern that Annex I Parties could "over-sell" and then be unable to meet their own emission targets, each Party is required to hold a minimum level of ERUs, CERs, AAUs and/or RMUs in their national registry. This is known as the commitment period reserve. It is calculated as 90% of the Party's assigned amount, as defined in Article 3.7 and 3.8, or as the level of national emissions indicated in the Party's most emissions inventory (multiplied by five, for the five years of the commitment period), whichever is the lower figure. Parties may also authorize legal entities to participate in emissions trading.[5]

Figure 3: Definition of Emissions Trading

A binding regime or regulatory entity that establishes a total amount of emissions from all sources over a specific period of time (a cap) and provides allowances in the form of permits that could be bought and sold to meet emission reduction goals or target (trade). After the allocation individual entities participating can choose to reduce their emissions (and sell their allowances) or increase their emissions (and buy allowances).[6]

Generating Tradable Emissions Credits from Transit-Oriented Development

While GHG emission reductions from the Owings Mill project would not be eligible for trading under any of the Kyoto Protocol's flexible mechanisms, it is instructive to review the Protocol's steps for quantifying emission reduction projects. We will then apply this methodology to the Owings Mills project.

Under the Kyoto Protocol, there are five components of the transportation sector that can be used to reduce emissions (and generate credits). They are: vehicle efficiency, GHG fuel intensity, level of transportation activity, mode of transportation, and amount of capacity used. Of these, mode shift is the key variable when estimating the GHG emission benefit from a transit and land use policy. Mode shift refers to the change in travel conditions (e.g., car to train, train to bike) as opposed to changing the technologies and fuels within each mode. Project investors wishing to

[4] Jürgen Lefevere, Programme Director, Climate Change & Energy Programme FIELD. *Greenhouse Gas Emission Allowance Trading in the EU: A Background.* Sept 2002.

[5] Please see, http://unfccc.int/issues/mechanisms.html

[6] Examples of market-based programs include: local air quality charges at airports in Sweden and Switzerland; an aviation fuel tax in Norway; sulfur dioxide emissions trading in the United States; and voluntary programs aimed at limiting greenhouse gas emissions in the United States, the Netherlands, the European Union and Australia. Source: US EPA, www.epa.gov.

generate credits for sale under mode of transportation would likely fund transit service improvements or land use policies that encourage the use of transit, walking, and bicycling.[7]

In order to quantify potential GHG emissions credits for JI or CDM investors must: determine the project baseline (projected emissions without the measure), make necessary baseline adjustments (e.g., correct for mode split changes over the life of the project), and consider leakage (indirect emissions resulting from the policy). Below we summarize the following steps to quantify GHG emissions credits.[8] Specifically, this requires the following:

Step 1: Develop an Initial Transportation Sector Baseline
A baseline is an estimate of the GHG emissions that would have occurred if a project were not implemented. A baseline, for the purposes of quantifying GHG emissions, does not have tobe tied to an individual project but can apply consistently to a certain area or region particular location. This means that a baseline development may help determine whether certain projects should be considered for implementation under Kyoto.

Step 2: Estimate the Change in GHG Emissions
Once a project is implemented, the actual emissions will often be very different from the original baseline. According to a recent report by the Organization for Economic Cooperation and Development, "the amount by whichactual emissions differ from the baseline determines the number of Certified Emissions Reduction (CERs) credits or Emission Reduction Units (ERUs) that are earned by the project."[9]

Step 3: Forecast the Business As Usual` Scenario
Beyond just quantifying the difference in emissions from before and after implementation, any CDM or JI projects must have a BAU or "business-as-usual" emission projection associated with them. While this type of forecasting can prove challenging in the transportation sector rigorous quantification approaches (i.e., projecting historic data forward, adjusting for fuel or fleet changes, and econometric modeling to capture trends) should be applied whenever possible.

Step 4: Consideration of Stringency and Additionally
Two important baseline terms are stringency and additionally. Stringency is associated with a baseline project and refers to how difficult it is for individual projects to achieve GHG reduction below the baseline. Regarding additionally, "Is a project additional?" is an important question because the Kyoto Protocol requires that, in order to earn credits CDM or JI projects must be actions that would not have occurred under BAU.

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[7] D. Salon. "An Initial View on Methodologies for Emission Baselines: Case Study on Transport, OECD and IEA Information Paper,", International Energy Agency, Paris, October, 2001.
[8] *Ibid* and Jürgen Lefevere, Programme Director, Climate Change & Energy Programme FIELD. Greenhouse Gas Emission Allowance Trading in the EU: A Background. Sept 2002.
[9] *Ibid*

Methodology for GHG Quantification from Owings Mills TOD Project

The steps for estimating the GHG emissions reductions from Maryland's Owings Mills project are noted below. Where appropriate, we discuss the need for further quantification and data and flag key questions for evaluating the potential for Owings Mills to generate emissionscredits (per the CDM methodology).

1. **Identify opportunities for TOD and mode shifts.**

2. **Estimate BAU for project.** The Maryland Department of Planning (MDP) ran the Baltimore regional travel model to get a BAU (as if the project had not happened).

3. **Estimate the VMT reduction for 2025 from the set of Scenarios.** MDP used the Baltimore regional travel model, using Baltimore City density to proxy the density increase for Scenario III at Owings Mills.

4. **Determine change in mode split, travel times, fleet by 2025** This was also done using Baltimore's regional travel model.

5. **Estimate the GHG emissions from the Owings Mills TOD project.** CCAP used DOE- and EPA-approved emissions factors to calculate the GHG reductions, based upon VMT reduction data provided by Maryland Department of Planning and the Baltimore regional travel model.[10] Future quantification efforts could include non-CO_2 emissions and variation of CO_2 emissions with vehicle speed.[11]

[10] ICF [(US EPA & DOT] Emissions Factors, Global Warming Potentials, Unit Conversions, Emissions and Related Facts, November 1999.
[11] CO_2 is the primary greenhouse gas from petroleum combustion, but emissions of N_2O can add a few percent to CO_2 equivalent emissions. CCAP has prepared equations describing how CO_2 emissions vary with vehicle speed.

The GHG reductions from Owings Mills Scenario II and III are included below. We have also included the effect on regional VMT (compared to the BAU Scenario I).

Figure 4: GHG Reductions from Owings Mills: Scenario II, III vs. Scenario I (Baseline or Trend)

Scenario II TOD site	VMT Reduction Per Day	$MTCO_2$ Per Day	Impact on regional VMT
Site Level - 3 TAZ's	78,525	35.6	+0.11%
Baltimore County	-81,400	-36.9	-0.11%
Region	-161,000	-73.0	-0.22%
Scenario III TOD w/ Increased Density	VMT Reduction Per Day	$MTCO_2$ Per Day	Impact on regional VMT
Site Level	61,681	28.0	+0.09%
Baltimore County	-253,100	-114.8	-0.35%
Region	-427,000	-193.7	-0.59%

$MTCO_2$ = metric tons of carbon dioxide
Note: Average passenger vehicle GHG emissions based on US DOE, *Transportation Energy Data Book*, Tables 7.1, 7.2. The 1.2% percent increase in regional transit trips is assumed to be accommodated by existing transit service, and therefore have no marginal emissions impact.

If the market price of CO_2 were $5.00 per metric ton, this project would generate $94,938 to $251,793 in annual GHG credits. Clearly this level of revenue is insufficient to fund the TOD project, but it could be applied to project monitoring and verification efforts as discussed below.

Impacts on Non-Motorized, Transit, and Motorized Trips

Baltimore County	**Non-Motorized Person Trips**	**% change**	**Transit Trips**	**% change**	**Motorized Person Trips**	**% change**
Trend	261,550	-	65,220	-	2,823,701	-
TOD	261,071	-0.2%	66,370	1.8%	2,826,439	0.1%
Modified TOD	309,709	18.6%	67,590	1.8%	2,828,427	0.1%

Baltimore Region	**Non-Motorized Person Trips**	**% change**	**Transit Trips**	**% change**	**Motorized Person Trips**	**% change**
Trend	1,241,000	-	322,960	-	9,163,000	-
TOD	1,240,872	0.0%	324,910	0.6%	9,161,403	0.0%
Modified TOD	1,246,000	0.4%	326,730	0.6%	9,160,000	0.0%

Depending on how robustly the model accounts for non-motorized transportation (e.g., intra-zonal trips), emissions reductions may be even greater. This is would be a fruitful area for further research.

Next Steps & Methodology Questions

The analysis of GHG reductions from the Owings Mills Project presented above represents an important first cut at assessing potential emission credit generation. It provides an order-of-magnitude sense of potential GHG emissions reductions available by concentrating mixed-use development near an existing transit station. In order to determine the actual GHG reductions from the project it would be necessary to establish a monitoring and verification methodology and effort. This could be accomplished using transit ridership data, passenger surveys, and traffic count data for all modes, including walking and biking.[12]

Key questions include:

- How effective is the proxy of Baltimore City to estimate density at Owings Mills?
- Where would development have gone without the TOD project? (a la Atlantic Steel and Digital Harbor analyses)
- Can modeling of non-motorized trips be improved? (E.g., how to capture intrazonal trips)
- What are the marginal GHG emissions from a transit trip? (E.g., what level of ridership increase would require increased transit vehicle trips?

Could Owings Mills Earn Air Quality Credits for Maryland's SIP?

Air Quality Emissions Credits from TOD

In June 2000, EPA issued a guidance document (so-called Voluntary Measures policy), which was subsequently revised, that offers a detailed information local air quality planners on how to receive credit for AQ reductions from land use policies (including TOD).[13] In order to obtain credits under the State Implementation Plan the guidance required emissions reductions to meet the SIP projections of seven years. This has proven to be hurdle due in part to the fact that land use measures may take as long as 10 years to show significant emissions reductions. Further, SIPs may not take credit for land use or other voluntary or market measures in excess of 3-percent (of the inventory).[14]

Prior to the Voluntary Measures policy document, the US EPA produced a paper detailing the challenges of quantifying GHG reductions from land use. According to the Agency, generating emissions credits for State SIPs runs into the following risks:

> "The danger in calculating travel and emission impacts off-model is that there may be secondary impacts of a local land use change that are not captured. For example, it's possible that a mixed-use development on an infill site could increase walking mode shares locally, but because the site

[12] The Center for Clean Air Policy is currently developing a methodology for monitoring TOD projects under the CDM, which we will share with MDP upon completion in 2004.

[13] See: http://www.epa.gov/otaq/transp/conform/policy.htm

[14] For more information, please see: 1) R. Schwarze and P. Zapfel, *Sulfur Allowance Trading and the Regional Clean Air Incentives Market: A Comparative Design Analysis of Two Major Cap-and-Trade Permit Programs?* (2000) 17 Environmental and Resource Economics, 279-298 and 2) EPA's Report: *Recognizing the Benefits of Local and State Land Use Policies and Projects in the Air Quality Planning Process.* (2000) Section 111 (a) 2 and 4.

> becomes a popular regional attraction, it would cause shoppers to drive farther than they currently do. Or the development could increase local congestion levels to the point where they negate the emission reduction due to increased walking. These secondary effects are difficult to measure without a region-wide model.
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> The nature of land use measures can also make them difficult to evaluate in isolation. Some regions feel that individual control measures have little impact in isolation, but the synergistic effects of a combination of measures is greater than the sum of the parts. In other cases, the benefits of several individual measures might overlap, and the cumulative impact is less than the sum of the parts. The only way to consistently treat these interactions would be to evaluate all measures under a single modeling framework."

Feng Liu, of the Maryland Department of Planning has addressed these issues in a recent paper on the emissions benefits of the Digital Harbor infill project.[15] The Digital Harbor project is one of several smart growth projects included in Maryland's SIP. Digital Harbor is a redevelopment project focusing on bringing high technology firms to an older neighborhood near Baltimore's Fells Point neighborhood. In terms of quantifying the impacts, this Digital Harbor analysis adopted the EPA-recommended quantification methodology and refined it to reflect the specific features of the Digital Harbor and the Baltimore modeling practice.[16] According to Mr. Liu:

> "In 2000, the official Baltimore Metropolitan Planning Organization (MPO) socioeconomic forecast estimated 248,500 households and 464,100 jobs in the City of Baltimore by 2005 and small increases to 253,700 households and 480,000 jobs by 2020 vs. BAU. The Digital Harbor projects will result in an additional growth of 26,400 jobs and 5,900 households by 2005 and 37,600 jobs and 10,400 households by 2020 in the City of Baltimore."
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> "For the Smart Growth SIP the MPO used [EPA] recommended quantification methods to estimate the air quality benefits for the Digital Harbor project. This included macro and micro level analysis. At the macro level a regional transportation model was used to evaluate travel and air quality impacts of these projects' central location. At the micro level, the Smart Growth INDEX (SGI) model was used to quantify travel effects and air quality benefits from land use density, diversity and design. For both 2005 and 2025 scenarios, the Smart Growth scenario has the smallest vehicle miles traveled, the highest non-motorized trips, and the smallest vehicle pollutant emissions. As expected, transportation and air quality benefits are larger in 2025 than in 2005."

For air quality, the State will need to consider the relatively small level of reductions against its SIP and determine if the effort to earn credit for the Owings Mills TOD is worth the resources to ensure it is counted within the 3% Voluntary Measures policy. Essentially, the policy makes the determination that States should implement programs that are thought to reduce emissions even if the emission reductions are difficult to quantify with certainty. This is an especially important policy for new types of programs that do not have a track record indicating effectiveness in reducing emissions. The policy recommends that a track record be established over time as the program is implemented. Therefore, implementation of new programs is not limited by lack of

[15] Feng Liu. "Quantifying Travel and Air Quality Benefits of Smart Growth in the State Implementation Plan." Transportation Research Board Annual Meeting, January 2003.

[16] In its 2000 report, *Comparing Methodologies to Assess Transportation and Air Quality Impacts of Brownfields and Infill Development.* the EPA concluded that two methodologies hold promise for accurate quantification and wide application in terms of evaluating the macro-level effects of land use strategies with a regionally calibrated travel demand model: (1) assume that growth would have gone to the fastest growing parts of the region and is distributed evenly among the fastest growing traffic analysis zones (TAZs) and (2) growth would be dispersed widely in the region, in amounts proportional to the distribution of all other growth. (see Liu, p. 4, Analysis Methodology section).

data or degree of uncertainty. Essentially, innovation is deemed more important in these instances than a high degree of certainty because the benefits potentially outweigh the risks and the scale of the program is limited to a maximum of 3% of the SIP.

Two key elements of the Owings Mills project analysis allow for increased confidence in the quantification of potential emissions reductions. First, by including non-motorized transportation (BMC Travel Demand Model indicates an 18% increase in NMT) a fuller scope of travel impacts is being addressed Second, the use of the regional travel model captures travel impacts in the broader travel network beyond the immediate project site.